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ELECTRICAL REVIEW

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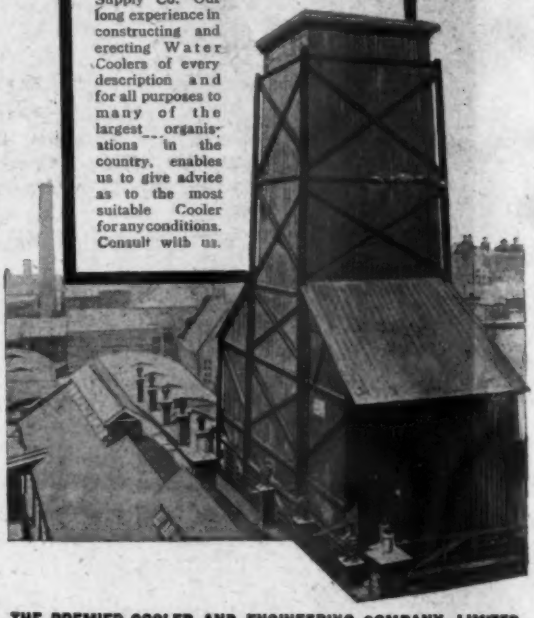

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ELECTRICAL REVIEW.

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A CRISIS IN ELECTRICITY SUPPLY.

THE letters from the Electrical Power Engineers' Association and the National Joint Board of Employers and Members of Staffs, of which we give summaries in our "Business Notes" to-day, leave no room for doubt that a very serious crisis has arisen in the electricity supply industry. Wearied with the prolonged delay on the part of the supply authorities, the great majority of which have refrained from compliance with the schedule of salaries drawn up by the National Joint Board, the Association has decided by a huge majority of votes to submit no longer to the undoubted injustice under which its members are suffering. Unless the schedule is adopted by December 11th, the members of the E.P.E.A. will cease work on December 14th, and the supply of electricity will inevitably be cut off in all the areas where the electricity works and sub-stations are operated by them—that is, practically throughout the country.

The situation is rightly described as very grave; the functions of electricity are so intimately interwoven with the industrial, commercial, social, and domestic life of the community in general that the cessation of supply would immediately make itself felt in every phase of our existence. To electrical readers we need not elaborate the point, with which they are familiar; they are well aware, too, that a strike of power station staffs could not be fought with voluntary labour. Like the miners, they are irreplaceable, and if they withhold their services the supply cannot be maintained, except in the smallest stations, where the chief engineer can perform the technical duties himself.

The Association demands that the schedule agreed upon in May last shall be accepted without reservation and put in force at once. The fact that the schedule has been adopted by some undertakings indicates that its terms are not unreasonable; it is not a demand emanating from employés alone, but one that has been formulated by a Joint Board on which both employers and employed are represented. At the convention of the Incorporated Municipal Electrical Association, in June last, a resolution was unanimously passed urging all municipal undertakings to comply with the awards of this Board as well as those of the National Council. The Ministry of Labour has induced the Electricity Commissioners to inquire whether an undertaking has adopted the schedule, before they grant permission to increase the charges for electrical energy. In the face of these facts it is impossible to impugn the justice of the claim. To urge that the industry cannot afford to pay the scheduled rates is utter futility; it is paying three times pre-war prices for coal, and nearly three times pre-war rates for labour, and to meet these costs the price of electrical energy has been raised like that of other commodities, but not so much. To put the matter in its true light, the value of money has fallen to two-fifths of its pre-war standard; a man who was paid £200 a year before the war should now receive £500 merely to maintain his original position, without regard to the advances that should have accrued to him during the six years' interval. But while the claims of coal and labour have been conceded, the staff men have been left out in the cold to struggle on as best they can. Even before the war, the salaries prevailing in electricity supply were absurdly low compared with those ruling in other professions, and only the engineer's love of his work, and never-failing cheerfulness in ad-

versity, kept him at his post. It is indeed high time that his unquestionable claims for adequate remuneration were recognised.

The position of the Association in this matter is unassailable. The question has been decided by the Joint Board; ample time has been given for deliberation; and some authorities have already accepted the schedule. The régime of autocracy has been swept away by the war; the claim of each authority to fix its own scale is inadmissible. The only hope of industrial peace resides in the maintenance of the authority of the Whitley Councils, one of which the Joint Board is officially recognised to be. We do not anticipate that the conflict will be carried to the point of actually stopping the supply of electricity, because the Association is the master of the situation. The Employers' Side of the Board is exerting every effort to avert the threatened strike by securing the recognition of the schedule to which it is a party, and we sincerely trust that its endeavours will be successful. But in the contrary event the country must face the inevitable consequences. We have always upheld the Whitley system as the best means to prevent industrial conflicts, but if its awards are not honoured the use of force is unavoidable, and our sympathy is wholly on the side of the party which adheres to the system. We, therefore, regard the action of the Association as fully justified; while we abhor strikes and shall continue to hope that milder methods may prevail, we abhor injustice still more, and we whole-heartedly support the claim of the Association that the decision of the Joint Board shall be honoured.

It will be noted that in the present case it is sought to establish the principle that the industry shall act as a whole. The strike threatened by the E.P.E.A. is a *national one*. It calls upon all undertakings not only to pay the schedule rates themselves, but also to take steps to ensure that all other undertakings pay them.

The issue is of immense importance to the industry. As we have never been tired of urging in these columns, what is called for is a consistent industrial policy on the part of employers, a settlement of basic principles, a statesmanlike outlook on the whole field. The E.P.E.A. letter shows that somehow or other many undertakings must be hopelessly out of touch with their immediate superintending staffs.

The I.E.E. Subscriptions.

The pocket is a very sensitive spot, and we were not surprised to receive a number of letters from readers on this subject, not all of which were intended for publication. The chief point for comment is a familiar one—the question of relative advantages as between town and country members, with which the headquarters building of the Institution is usually coupled. Those who are unable to attend the London meetings see no reason why the London members should rejoice in the possession of palatial premises at the common charge.

Whilst we regard the matter, as a journal, from a purely external and disinterested point of view, we cannot help feeling that this attitude is somewhat parochial and unworthy of the members of so large and influential a society. The mere accommodation is but one aspect of the question. Undoubtedly the Institution's own building is the most convenient and suitable locus for the Institution meetings—but that in itself would not justify the purchase of a costly building. The housing of the offices and the splendid library of the Institution is an important consideration, and would involve no small expense if the building were not available; moreover, there is the question of prestige, which is not to be ignored. That a society numbering over 8,000 members, of whom some 2,400 are within the London area, should have no suitable home in London would be unthinkable, and therefore, to our mind, the only uncertain factor is the question whether the building is too costly. In view of the scarcity of accommodation that prevails in London, we have no doubt that the portions of the building which are not immediately needed by the Institution for its own purposes will readily be leased. Another valuable consideration is the ability to offer hospitality to kindred institutions which is afforded by the possession of roomy headquarters; while no rent can be charged for such user, the out-of-pocket expenses are repaid, and this form of hospitality—which has been freely conferred upon the Institution in the past—is a useful means of maintaining a close connection with the numerous allied associations such as the Post Office Engineers, the Wireless Society, the Society of Engineers, and many others, which have enjoyed it in the past. The building, therefore, appears to us to be thoroughly justified.

But another point has been raised by country members, namely, why should they, who cannot enjoy the privileges of the London members, pay the same subscriptions?—and this, we think, is a well-founded complaint. Where a country member is within reach of a Territorial Centre or Sub-centre, which necessarily incurs expenses that are defrayed out of the common chest, the claim for relief may not be justified, but many members are domiciled far from any meeting-place, and not only pay the full subscription, but if they do attend a meeting they have to incur heavy travelling and hotel expenses in addition. It certainly seems that some concession is due to members in such a position, though whether it is possible to devise a workable method of discrimination is a difficult question to answer. Elsewhere we give the schedules adopted by the two great Institutions most closely akin to the I.E.E., which will enable members to form their own opinions regarding this subject.

At this time, when expenses are increasing, the old question of a common home for all the engineering institutions may appropriately be raised again; this would greatly diminish the cost to each society, whilst adding very greatly to the benefits derived from it by individual members, and would of course increase the "utilisation factor" of the lecture theatres, &c., which under present conditions is often very low. The United States and several of the British Dominions have already adopted this policy. But this subject must be deferred to a later issue.

Non-statutory Companies.

There is a good number of non-statutory electricity supply companies scattered up and down the country. It is difficult from the nature of the case to say how many, but all of them are small, of course. Under the Electricity (Supply) Act, 1919, there is a section (No. 26) by which these can be regularised by special order, which abbreviates the former method of Provisional Order procedure. The special rules and directions under which such special orders could be obtained have recently been issued, and are at the service of any non-statutory company which is disposed to become a statutory undertaking. There is one point which it would be particularly well to cover in such cases, namely, that the company in becoming statutory should be considered as having complied with Section 14 of the Electric Lighting (Clauses) Act, 1899. This section obliges the undertaker to give notice to the local authority when mains are being laid. The importance of compliance is that later (Section 17, Sub-section (*i*)) provision is made as regards repayment of expenses in connection with alterations in the roadway, and such like, which require consequential alteration in the position of the mains. Where, for instance, a local authority decides upon an alteration in the level of the road, or straightens a road, or does any work that compels an undertaking to take up, relay, or in any way work on its supply mains, the local authority has to pay the cost. But the section only applies to authorised undertakers; a non-statutory company is left out in the cold. Hence the importance of the retrospective provision above mentioned when any company becomes statutory after its mains have been laid.

ELECTRIC ROLLING-MILL EQUIPMENT FOR MESSRS. STEEL, PEECH & TOZER, LTD.

The past few years have witnessed enormous strides in the application of electricity to steel works. Originally looked upon as merely a convenient means of operating such auxiliaries as cranes, live rolls, screw-downs, &c., electricity is now deservedly recognised as a highly efficient and economical means of driving the rolling mill itself irrespective of its capacity or type. As an illustration of what has been done in this direction, the following

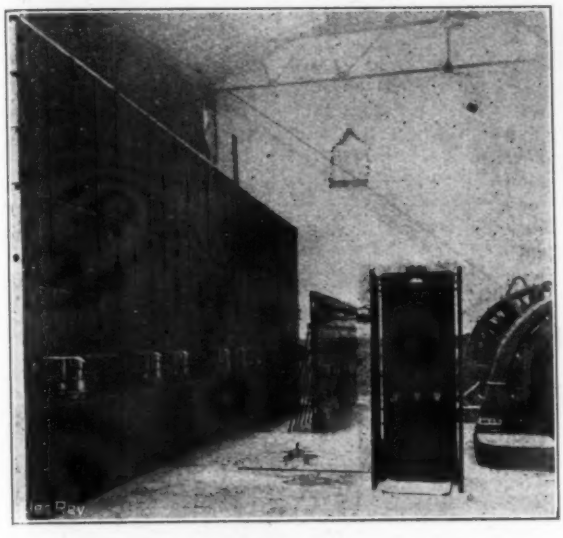

Fig. 1.—General View of Sub-station, showing H.T. Switchboard.

description of the equipment installed at Messrs. Steel, Peech & Tozer's Templeborough Works, Rotherham, by the British Thomson-Houston Co., Ltd., of Rugby, with Mr. G. M. Brown as consulting engineer, may be of interest.

For the purpose of this article the electrical equipment may conveniently be divided into four sections, as follows:—

Sub-Station Equipment.—The supply for the entire mill is taken from the Rotherham Corporation* by means of three-phase, 50-cycle, mains at two voltages, the larger proportion being at 6,300 volts, and the remainder at 3,000 volts. The sub-station contains switchgear for distributing the power to the various mill equipments, together with suitable converting plant for giving a D.C. supply for the operation of the various mill auxiliaries.

The 6,300-volt supply is controlled by means of solenoid-operated remote-control switchgear, the oil switches being mounted in moulded stone cells; the arrangement of the gear is illustrated in fig. 1. Duplicate bus-bars are provided throughout, each set being capable of carrying the full load of the board, and separate compartments are provided in the cellwork for each set of bus-bars, each set of bus-bar selector switches, oil switch, and instrument transformers. The various compartments are closed by means of sheet-iron doors, and suitable interlocks are fitted between the bus-bar selector switches and the isolating switches, rendering it impossible for the attendant to have access to the oil switch and instrument transformer chambers unless both sets of isolating switches are in the "off" position.

This arrangement of compartment-cell structure greatly facilitates the handling of the switchgear when access to the individual equipments is required for inspection or cleaning purposes, as when the bus-bar selector switches are disconnected on any unit the oil switch and instrument transformer on that particular unit are entirely "dead."

The oil switches are of the solenoid-operated type, each switch consisting of three single-pole units. The oil tanks are of the welded type, built up of boiler plate and reinforced with stout channel iron. The contact units are of the controller-finger type provided with special steel backing springs. The incoming feeder switches are of the split conductor type, fitted with special contact units: the latter switches have a rupturing capacity of 100,000 K.V.A. at 6,600 volts. The bus-bar isolating switches are of the triple-pole rotary type, and arranged to be operated from the outside, a special detachable handle being provided for the purpose.

The operating panels for this switchgear are of the flat-back type, consisting of enamelled slate panels mounted on pipe framework, and are mounted on the floor of the sub-station in front of the stone cellwork. The incoming feeder equipments are provided with split-conductor protective gear, the outgoing feeder units being fitted with overload and low-volt protection. The above switchboard is built up of the following equipments, commencing at the right-hand side:—Four split-conductor incoming feeder equipments; one total output bus-bar metering equipment; one bus-bar coupler equipment; one 3,000-H.P. feeder equipment for the cogging mill; one 1,250-KW. rotary converter equipment; one spare 1,250-KW. rotary converter equipment; one 5,000-H.P. feeder equipment for the billet mill; one 1,200-H.P. feeder equipment for the slab mill; one spare 300-ampere feeder equipment; and one 300-KW. transformer equipment for hydraulic pumps.

With regard to the control board, two panels are provided for the metering equipment to accommodate duplicate meters, and synchronising equipments are provided in the case of the rotary-converter panels.

The 3,000-volt supply is controlled by means of a truck-type switchboard consisting of four panels as follows:—One incoming feeder panel; one outgoing feeder panel for the Templeborough sub-station; one outgoing feeder for the 1,250-KW. motor-generator; and one spare feeder panel.

The converting plant for supplying D.C. to the various mill auxiliaries consists of a motor-generator set and a rotary converter, each of 1,250-KW. capacity. The motor-generator set comprises a 3,000-volt, three-phase, 50-cycle, slip-ring type induction motor taking its supply from the 3,000-volt truck-type switchboard, and direct-coupled to a 1,250-KW.,

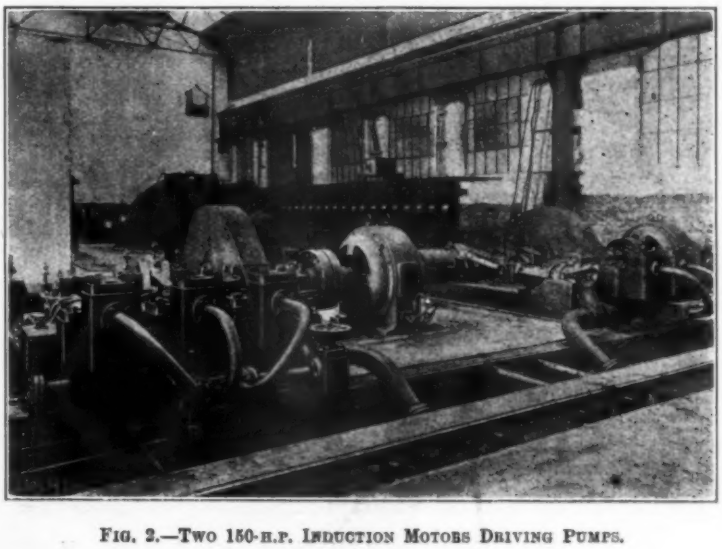

Fig. 2.—Two 150-H.P. Induction Motors Driving Pumps.

* Elec. Rev., November 5th, 1920; p. 583.

375-r.p.m., 200/250-volt, 5,000-ampere, compound-wound commutating pole generator. The set is started up by means of a tramway-type controller and a cast-grid resistance connected in the rotor circuit of the induction motor. The rotary converter is of the induction-motor started, self-synchronising type, rated at 1,250 kw., 500 r.p.m., 50 cycles, six-phase, the d.c. voltage being 200/250. The machine is compound-wound, and takes its supply from the 6,300-volt switchboard through a 1,380-k.v.a. self-cooling, oil-immersed transformer mounted in the basement. The characteristic of the machine is such that it can be run in parallel with the motor-generator set if required. At the time the mill equipment was put in hand, the converting plant described above was considered sufficient to meet the immediate demands for a d.c. supply, but it was recognised that the demand for direct current would be likely to exceed the capacity of this plant when the entire mill was put in commercial service. This point has now been reached, and a duplicate rotary-converter equipment is in course of manufacture at the works of the B.T.H. Co.,

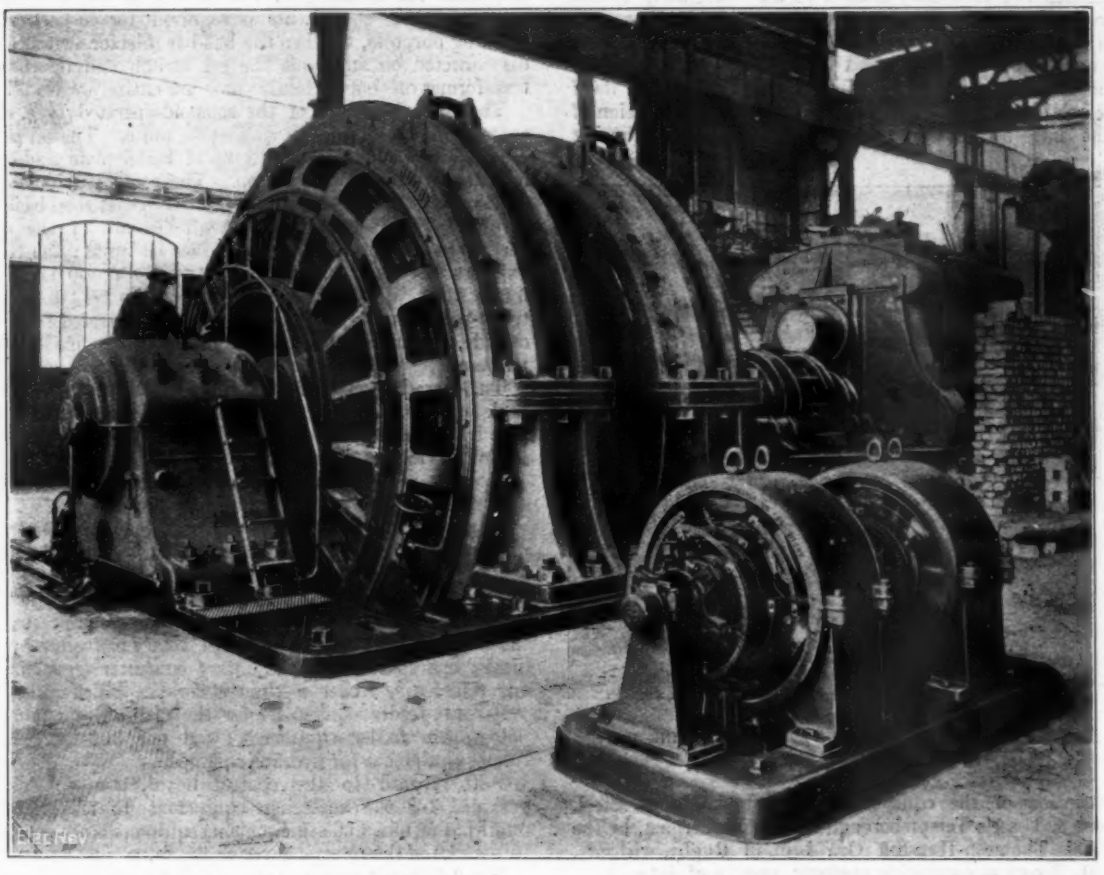

Fig. 3.—A B.T.H. 6,000-15,500-h.p. Double Motor Driving Cogging Mill; Exciter Set in Foreground.

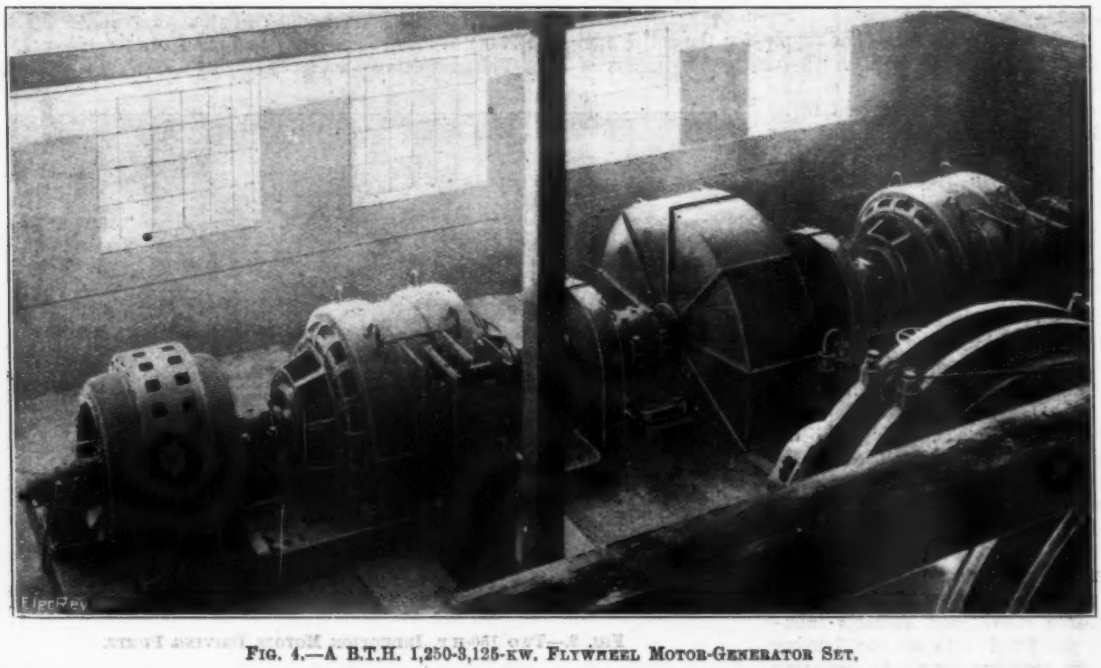

Fig. 4.—A B.T.H. 1,250-3,125-kw. Flywheel Motor-Generator Set.

Rugby. For controlling the D.C. supply from the above two machines a 25-panel black-enamelled slate switchboard is installed, which consists of one 1,250-KW. generator control panel; one 1,250-KW. rotary control panel; and 21 1,200-ampere feeder panels, the remaining two panels being blank.

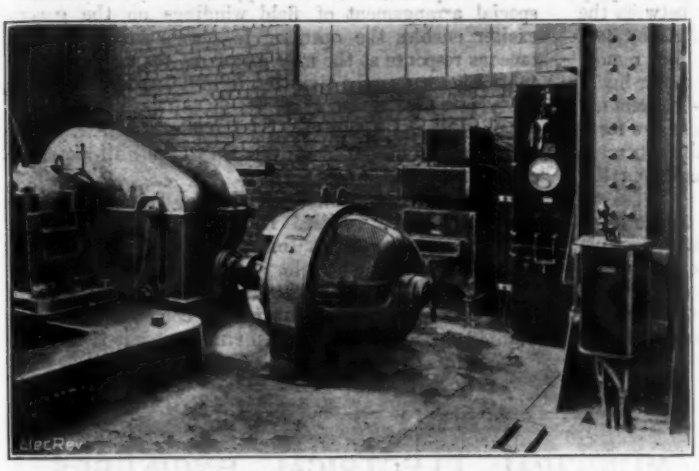

FIG. 5.—FLYWHEEL BARRING GEAR DRIVEN BY 30-H.P. MOTOR.

Reference has already been made to the hydraulic pumps in describing the functions of the various units of the 6,300-volt switchboard. These pumps are of the Davy ram type, and supply various hydraulic auxiliaries in the mill through the medium of a hydraulic accumulator. There are two pumps, each driven by a 150-H.P. induction motor. The supply for these motors is taken from the 200-K.V.A. transformer mentioned above, and is controlled by means of pedestal type ironclad switchgear of the B.T.H. Co.'s O.D. type. The rotor circuits are controlled by automatic contactor type starting panels operating in conjunction with tappet switches worked by the accumulator, the motors being automatically started or stopped in accordance with the fluctuations in the demand for hydraulic power. The pumping equipments are clearly shown in fig. 2 with the converting plant and 220-volt D.C. switchboard in the background.

Cogging Mill Equipment.—The cogging mill is one of the largest in existence, and is of the two-high reversing type having rolls 36 in. in diameter. It is driven by a double unit motor, shown in fig. 3, having a normal rating of 6,000 H.P. and a peak rating of 15,500 H.P. The machine was guaranteed to develop a torque of 760 ton-ft. at any speed up to 48 R.P.M., but was actually tested under conditions corresponding to a torque of 1,000 ton-ft.

The supply for the mill motor is obtained from a motor generator set consisting of a 3,000-H.P., 6,300-volt, 600-R.P.M. induction motor coupled to four 1,250/3,125-KW., 375-volt generators, and two 30-ton flywheels 11 ft. 6 in. in diameter. The set is shown in fig. 4, from which it will be seen that the generators are arranged as two double-unit machines. The flywheels are placed between the two double generators, and are enclosed in a sheet steel casing, as are also the two special B.T.H. flexible couplings connecting the flywheels to the generators on either side.

For starting the set from rest and for rotating it slowly for inspection or adjustment, the barring gear shown in fig. 5 is provided. This operates on the shaft of the generator, remote from the induction motor, and is so arranged as to automatically disengage the gears when

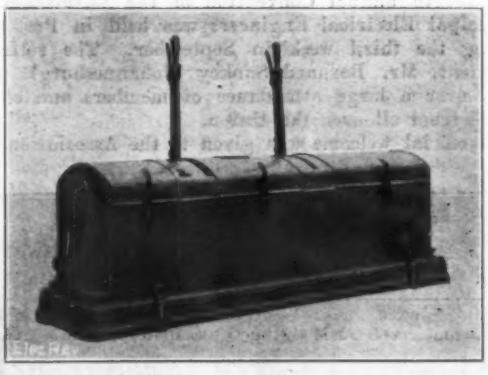

FIG. 6.—WARD-LEONARD COGGING MILL CONTROLLER.

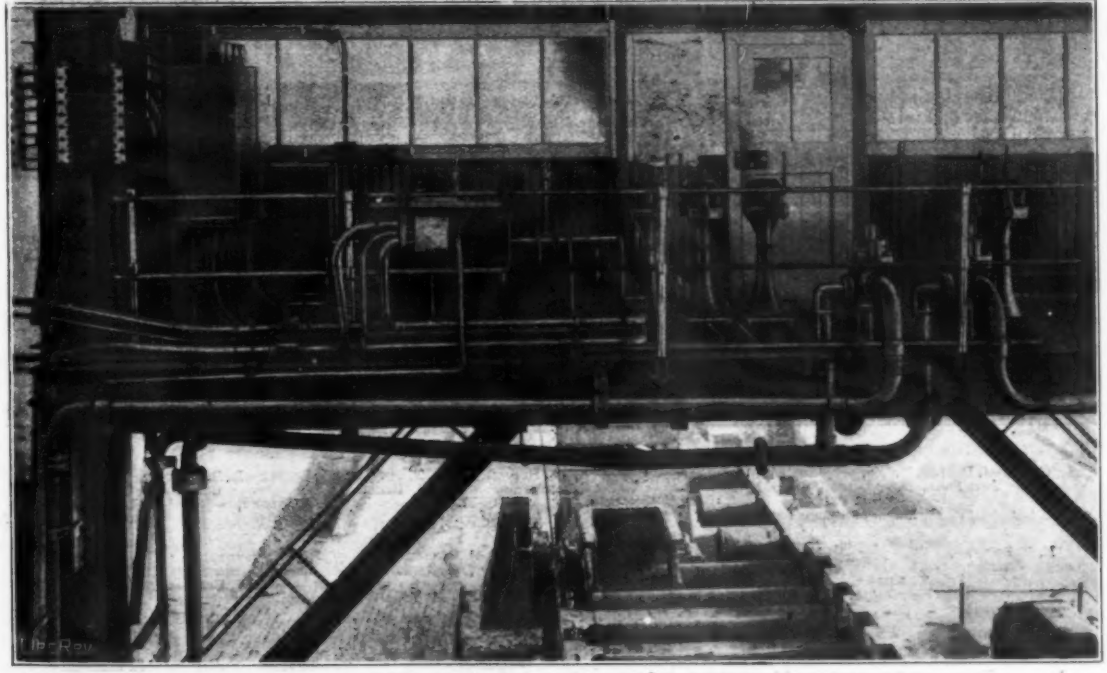

FIG. 7.—VIEW OF MILL CONTROL PULPIT.

the induction motor picks up the load at starting. The gear is driven by a 30-H.P., 220-volt, B.T.H. motor. The mill motor is controlled on the well-known Ward Leonard principle, the main controller being shown in fig. 6. This controller is mounted on the main control pulpit over the mill, as shown in fig. 7. The four generators of the flywheel set are connected in series, giving a maximum voltage of supply to the mill motor of 1,500 volts, the circuit between the generators and the mill motor being controlled by two solenoid-operated circuit-breakers arranged for remote control either from the D.C. switchboard in the motor-house or from the pulpit in the mill. The circuit-breakers are shown in fig. 4. A special exciter set, shown in the foreground of fig. 2, provides the excitation for the generator fields, the mill motor field being excited direct from the mill supply at 220 volts.

It will be seen from fig. 6 that the main controller is provided with two levers. The right-hand lever controls the exciter field and enables the generator voltage to be built up for either forward or reverse rotation of the mill motor, according to the direction in which the lever is moved from its mid position. The full movement of the lever gives a voltage of supply to the mill motor of 1,500 volts, under which conditions the speed is 48 R.P.M. The second lever controls a contactor panel by means of which resistance can be inserted in the mill-motor field circuit, increasing the speed of the machine to a maximum of 100 R.P.M. The two levers are so interlocked that it is impossible for the operator to weaken the mill motor field until full pressure has been applied to the armature. A special arrangement of field windings on the generator exciter enables the operator to obtain practically instantaneous response at the mill motor to the movement of his control lever, *i.e.*, the time lag in building up the generator fields is reduced to a minimum. The same result is obtained when operating at speeds above 48 R.P.M. by means of a special differential relay fitted to the mill-motor field-contactor panel.

The extent to which the desired results have been obtained will be realised from the following results of oscillograph tests taken on the equipment, when it is remembered that the weight of the mill-motor armature is approximately 90 tons: Time for reversal from 100 R.P.M. forward to 100 R.P.M. reverse is 4½ seconds, and for reversal from 48 R.P.M. forward to 48 R.P.M. reverse it is 2½ seconds.

(To be concluded.)

THE ASSOCIATION OF MUNICIPAL ELECTRICAL ENGINEERS.

(Union of South Africa.)

THE fourth annual Convention of the Association of Municipal Electrical Engineers was held in Pretoria, during the third week in September. The retiring president, Mr. Bernard Sankey (Johannesburg), presided over a large attendance of members and councillors from all over the Union.

An official welcome was given to the Association by the Mayor of Pretoria (Mr. C. W. Giovanetti, M.B.E., M.L.A.), after which the retiring president read his valedictory address.

The officers for the next year were then elected: Mr. T. C. Wolley-Dod (Pretoria), president; Mr. G. H. Swingler (Cape Town), vice-president; Messrs. T. Millar (Harrismith), E. Poole (Durban), L. Bickell (Port

Top Row

Prof. Dobson, D.S.O., *Past President.* — W. Douglas, Ermelo. — W. A. Hodge, Standerton. — T. Sutcliffe, Benoni. — L. B. Proctor, Boksburg.

Coun. Pedley, Mayor of Standerton. — Prof. Buchanan, Visitor. — G. Mercier. — B. A. Stoker, Kroonstad. — L. L. Horrell, Pretoria, *Hon. Sec. & Treas.*

Middle Row.

R. F. Botting, Visitor. — P. McCauley, Bloemfontein. — L. B. Sparks, Pietersburg. — W. H. Blatchford, Greytown. — R. B. Coulthard, Oudtshoorn. — Coun. Hoy, Port Elizabeth.

T. Miller, Harrismith. — T. P. Ashley, Queenstown. — G. W. McComb, Springs. — J. Vowles, King Williamstown. — W. Bellad Ellis,

Sitting.

W. Fletcher, Krugersdorp. — Coun. Clark, Johannesburg. — Coun. Giovanetti, M.B.E., M.L.A., Mayor of Pretoria. — Coun. Bischoff, Pretoria. — Coun. Cunningham, Cape Town.

J. Roberts, Durban, *Past President.* — B. Sankey, J'burg, *Past President.* — T. C. Wolley-Dod, Pretoria, *President.* — G. Swingler, Cape Town, *Vice President.* — L. Bickell, Port Elizabeth.

Elizabeth), and L. B. Proctor (Boksburg), members of the Council. Mr. L. L. Horrell, of Pretoria, was elected hon. secretary and treasurer in the place of Mr. Poole, who had resigned.

On the conclusion of the morning's business the Mayor entertained the members, together with the Town Councillors, to luncheon at the County Club, and in the afternoon a visit was paid to the Municipal power station.

On the Tuesday morning the president addressed the Conference, after which Mr. Mercier (Bethel) read an interesting paper on gas-engine plants, with special reference to their use as prime movers in small generating stations. The Conference then adjourned to visit the Pretoria iron mines.

In the afternoon committees were elected to deal with the following subjects: "Licensing of Electricians' By-laws," "Conditions of Supply and Wiring Regulations," "Remuneration of Electrical Engineers," and "Statistics and Accounts."

On the Thursday the members were taken to see the Premier Diamond Mine, and on the return journey a call was made to see the Hatherley glass works. In the evening the annual dinner was held in the Pretoria Club. Mr. T. C. Wolley-Dod presided, and was supported by his Honour the Administrator of the Transvaal, Mr. A. G. Robertson, and the Mayor of Pretoria. Many other well-known men were present, including Councillor H. J. Raley, Mayor of Standerton, and Councillors A. Cunningham (Cape Town), T. Hoy (Port Elizabeth), and J. A. Clark (Johannesburg).

On the Friday the Committees submitted their reports to the Congress.

Licensing of Electricians and Registration of Contractors.—The Committee dealing with this report felt that it was useless to license electricians for wiring and subject them to penalties for bad work or infringement of the regulations, unless the municipality had some control over their employers. It was, therefore, strongly recommended that all wiring contractors should be registered, and draft regulations dealing with the matter, together with the regulations for licensing electricians, were submitted to the meeting, which, after discussion, were passed.

By-Laws, Conditions of Supply, and Wiring Regulations.—The president introduced the report of the Committee, and, after discussion and some amendments, it was passed.

Remuneration of Electrical Engineers.—As this matter had already been taken up by a committee of members of the S.A. Institute of Electrical Engineers and members of the Municipal Electrical Engineers' Association, the Congress passed a resolution to be submitted to the Joint Board, *i.e.*:—"That the minimum salary of a whole-time municipal electrical engineer shall be 15 per cent. above the standard rate of wages paid to skilled engineering artisans in the district," and suggested that the Joint Committee should draw up a scale of salaries for the larger stations.

Statistics and Accounts.—The Congress considered that it would be advisable to get the views of the different town treasurers on the subject, and bring the matter up at the next Convention, which will be held in Cape Town about October, 1921.

After appreciative references had been made by the visitors with regard to the week's work, the session concluded with a visit in the afternoon to the Government railway workshops.

THE ELECTRIFICATION OF LAUNDRIES.

By E. AUSTIN.

As a laundry is an establishment in which clothes and other articles are washed and made clean (?), it naturally follows that it is one of the last places that should not contain anything which consumes gas. Just recently the writer has been permitted to contribute a series of electrical articles to an important laundry journal, with the result that innumerable gas appliances have been consigned to the scrap-heap. The use of electricity in laundries vastly improves the conditions under which the workpeople perform their duties, and increases the output. It is said, in fact, that in some laundries where at one time it was difficult to get any work done at all, the introduction of electricity has made the workrooms so congenial that it is now often next to impossible to get the employés to stop work and go home.

One of the things that is essential in a laundry is, of course, good light. Operators cannot be blamed for damaging goods if they are compelled to work with inadequate and unhealthy illumination. What is wanted, and what is adopted by all go-ahead laundry proprietors, is electric light produced by gasfilled lamps used in conjunction with scientifically designed reflectors. Good lighting invariably reduces the number of compensation claims of the customers, who strongly object to having their goods torn and scorched. Half the troubles and disputes that arise in connection with washing are attributable, directly or indirectly, to gas, but when electrical appliances are adopted the shirts and collars, blouses, petticoats, and so forth leave the laundry free from damage, and when all the members of the washing and dyeing and cleaning professions utilise electricity the resultant benefits will be felt and appreciated by the entire community.

Years ago Messrs. Eastman & Sons, the well-known dyers and cleaners, who employ some 300 workers in their ironing rooms alone, adopted electric irons, with excellent results. The irons eliminate the risk of scorching the work and of making it dirty. The workrooms, moreover, are always clean and cool, and the workers consequently perform their duties under good conditions, and are always happy and contented. In this particular case, the irons used are those made by the Dowsing Radiant Heat Co., Ltd., which has applied electric heating to various other appliances used in laundries and dyeing and cleaning establishments. Goffering machines, neck-banders, collar-edgers, collar-ironers, body-ironers, and similar machines of all the principal makes have been successfully fitted with electric heating elements made in accordance with the Eastman and Warne patents. For all heating work usually done with gas, electricity can be utilised with infinitely better results. All the fumes which pollute the atmosphere and make it unhealthy can be eliminated by the adoption of electric heating, and even in the summer months the workrooms are not unduly hot or stuffy.

Besides light and heat, laundries require power. Vast numbers of electric motors have been installed in laundries for driving the washing and other machines, and it is invariably found that they answer the purpose admirably. Group-driving is usually adopted, and the grouping of several washers and extractors works out very well. Hydro-extractors, however, are frequently fitted with independent motors of the vertical type, and several firms, such as Messrs. Thomas Broadbent, of Huddersfield, and Manlove, Alliott, of Nottingham, supply electrically-driven extractors in various sizes and suitable for large and small laundries. Large ironing machines can be, and frequently are, fitted with independent motors, when the speed can be varied electrically, and overtime ironing jobs can be accomplished without running the entire driving equipment. An ironing department of a large laundry provided with these electrically-driven machines with independent motors is a far more congenial place than a similar apartment equipped with machines that are driven mechanically. All the belting and shafting inseparable from the mechanical driving system are, of course, absent, and the workroom is a lighter, cleaner, healthier, and in every way a better place to work in. Electric driving has often proved a tremendous boon to those who run small laundries. In laundries of this sort a single motor is in many cases used to drive all the machinery, instead of an engine. Often when

engines have been scrapped, and the electric drive has been introduced, the capacity of these small laundries has been considerably increased. By fixing motors on wall brackets or to overhead girders valuable floor space can, of course, be saved, and it has in many cases been possible to install another washing machine, and so increase the output without extending the building. Moreover, the electric drive renders the laundry practically immune from breakdown.

The installation of electric light and power in laundries naturally calls for care. In the wash-house, moisture is, of course, present, and care must be exercised to protect the lighting fittings and motors. For driving the wash-house equipment, totally enclosed motors are essential, or alternatively the motors must be placed outside the wash-house, where they are unaffected by dampness or steam. In other parts of the laundry where dampness is absent, semi-enclosed motors may be adopted. The wiring of a wash-house is another matter which calls for special precaution. In consequence of the presence of steam and water, an unsuitable wiring system or unsuitable fittings may lead to no end of trouble and expense, and cause laundry owners to wish that they had never abandoned gas. The best wiring system to adopt is perhaps a debatable point, but the writer understands from Mr. J. H. C. Brooking that for wiring laundries, and, in fact, all other places in which arduous conditions are encountered, cab-tire sheathed cable is admirably adapted.

The production of sodium hypochlorite for cleansing and sterilising linen is another use to which electricity can be put in laundries. Electrolysers for this purpose made by Messrs. G. W. Thornton & Co., of Salford, Manchester, have been supplied to many important laundry firms, as well as to shipping companies, such as the White Star and Cunard Co.'s. In Liverpool alone no fewer than twelve of these electrolysers are in operation. It is invariably found that the electrolytic bleach which they produce reduces the work of the rotary washers, thus diminishing the baneful grinding and pounding, whilst at the same time the linen is made as white as when it was new. Moreover, as a disinfectant, germicide, deodoriser, or antiseptic, sodium hypochlorite is extremely effective and cheap. The liquor placed in the electrolyser merely consists of water and coarse salt, such as that used for curing fish, and in pre-war days 12 gallons of the bleach could be made at the cost of 1d., which is considerably below the cost of any other solution used for the same purpose. The electrolyser itself consists of a rectangular stoneware box, divided by carbon plates into a number of compartments, the end plates forming the anode and cathode. The passage of the current from one end of the electrolyser to the other produces a lively effervescence in the cells, owing to the evolution of hydrogen, and the liquor required for use overflows at openings at the sides of the electrolyser into a storage tank, and fresh liquor enters through holes at the bottom.

When the clothes have been washed, starched, and ironed, it remains to distribute them to the customers or branch shops. For this purpose nearly all laundries are at present using horse or petrol vans, but sooner or later they will undoubtedly employ vans propelled by electricity. Once the laundry owners recognise that electric vans are clean and inexpensive to run and maintain, and are practically immune from breakdown, the vans they are now using will soon be abolished. The high cost of petrol and the great expense involved in keeping mechanically-propelled vehicles in repair, are causing many business people to investigate the merits of electricity. For laundry work electric transport is, of course, ideal, and electric vehicle manufacturers should not fail to keep well in touch with the laundry business.

Receivership.—Rotasphere Co., Ltd.—Mr. J. Grant, of 47, Victoria Street, Tue Brook, Liverpool, ceased to act as receiver or manager on October 26th, 1920.

CALCULATING MACHINES APPLIED TO THE ELECTRICAL INDUSTRY.

By A. CLEGG, A.C.I.S.

During the last few years the importance of introducing labour-saving machinery and devices has been acknowledged in almost every factory and works in the kingdom. It is up to the office organisation to keep pace and increase production by introducing the latest labour-saving machinery and devices into the office, and, unlike many of the machines which are installed in the works, it will often be found that office machines pay for themselves in a few months. America has left this country far behind in this respect, figure-work in that country being done almost entirely by machinery which is still being done by hand here. The writer read an article a short time ago, setting out a new system of accounting adopted by the Philadelphian Electric Co., from which they estimate a saving of $50,000 a year, the saving being mainly brought about by labour-saving machinery and devices in the office.

Office staffs of electricity undertakings are usually not on the large side, and the employment of office machinery will enable detailed statistics and data to be placed before the management which could not otherwise reasonably be called for, owing to the labour involved in collecting such information.

A certain amount of antipathy may be evidenced by the average clerk at the mention of office machinery, but once the machinery is installed, and the staff understand its working, the extra work turned out soon overcomes their prejudice, and many now object to performing the calculations by mental operations.

The engineer carries his slide rule about with him, and brings it out every time figures are mentioned; these save labour, and many clerks also use them for rough calculations; but for accurate calculations the clerk must use a "calculating machine." There are many different kinds of calculating machines on the market; the uses to which they can be put are percentages, costings, invoice extensions, dissections, and actuarial and statistical calculations. Calculating machines can be divided into two broad classes—key-operated and crank-operated machines; this article will deal with the latter class as applied to calculating large power electricity accounts and pay-roll work.

The tendency of large generating stations is to supply electricity for power purposes, and as the prices vary according to the load, &c., I do not propose to enter into details, except to say that the calculating machine can be used equally well whether the price is a flat rate of so much per unit or so much per K.V.A. of maximum demand.

In the undertaking with which the writer is acquainted the charges are based on the K.V.A. of maximum demand plus a unit charge, and also an addition for any increase in the cost of coal.

The working out of the K.V.A. returned by the meter reader is checked by a calculating machine, the charges to a consumer are all done on the calculating machine, and the accounts have been sent out in half the time they were under the old method, and have also been found to be much more accurate, and the additional consumers connected have hardly been felt by the staff concerned.

It will, perhaps, be clearer to the reader if I give an example of the work of the consumers' clerk dealing with the accounts, beginning with the meter sheet.

When a large power consumer is connected, this meter sheet is made out from the particulars on the connection note, and needs little explanation except that current transformers are mainly used, and therefore in calculating the maximum demand a constant must be brought into the calculation; a space is provided for this.

The reader may also be curious to know what the space marked "multiplying factor" signifies; this figure (assuming a three-phase supply) is made up of—

$$\text{volts} \times \text{constant} \times \sqrt{3}/1{,}000,$$

and does not vary unless the equipment is changed, so saving 75 per cent. of the calculation each month. For example:

Suppose the demand indicator reads 5 amperes, supply is 400 volts and current transformer 25/5 = (constant 5), to get at the K.V.A. the old method would be—

$$5 \times 400 \times 5 \times 1{\cdot}73/1{,}000 = 17{\cdot}3.$$

In the new method the multiplying factor would be shown as 3·46, which only requires multiplying each month by the amperes, in this case 5, which is 17·3. Now that the maximum demand has been checked on the calculator we can proceed to the working out of the account. Let us assume the price of energy is 6s. per K.V.A. + 0·45d. per unit.

METER SHEET.

District ..... No .....

Name .....

Address .....

.....

W. Meter No..... Amps.....Volts.....Duty..... Ct.....

C.T. { No. ..... Ratio ..... P.T. { No. ..... Ratio .....

D.I. No. .....Amps..... Supply volts ..... Duty ..... Multiplying factor ...

D.I., C.T. No.....

Date.	Reading.	Difference.	Total units.	Amps.	M.D. volts.	K.V.A.	Read by

The keys of the calculator representing 17·3 would be depressed, and the crank-handle turned three times as 6s. = ·3 of a £, the answer appearing on the dial in pounds; the only thing to be careful about is the decimal point, and small pointers are attached to the machine for this purpose. The same method is used for the unit charge; say, 12,796 units have been consumed, the keys representing these numbers are depressed, and the crank turned five times, the whole carriage moved one to the left for the tens, and the crank turned four times, keeping the decimal point carefully indicated, the answer appearing on the dial in pence; this is brought to pounds by depressing the keys 240 and reversing the crank-handle for division. It will be seen that the metric and decimal systems play a large part in this class of account, and these in themselves facilitate the use of the calculating machine.

The calculating machine has also been found extremely useful on pay roll work, and has considerably reduced the work each week, and the extra work involved in calculating the ante-dated recommendations of Whitley Councils, &c., has been got through with the minimum of time and labour. In this case lists of reciprocals are prepared for the use of the wages clerk, representing the wages of the various grades. Taking a 47-hour week and requiring the answer to be read as a decimal of £1, we divide 47 into ·05 (1s. as a decimal of a £1) which gives us a permanent reciprocal for a 47-hour week of ·00106383. This figure is put into the machine and multiplied by the rate per week, viz.,

$$\cdot00106383 \times 69\text{s.} = \cdot073405.$$

This figure of ·073405 becomes the wages reciprocal whilst the rate is in force; these reciprocals are tabulated in money order on cards, and all that the wages clerk has to do each week is to put into the machine the figure shown against each rate and multiply (by turning the crank) by the number of hours worked, the answer being read in pounds and decimal parts, for example:—72 hours at 69s. for 47 hours would be ·073405 × 72 = £5·285 (£5 5s. 8d). The reading of these decimal points becomes quite simple after a little practice.

One big advantage of the calculator is that the reciprocal need not be taken out of the machine for each man's wages, but for the different hours worked all that is needed is the crank turning to meet the change of hours. The machines can also be used for all classes of work, such as working out the various departmental costs per unit generated or sold, and extensions of invoices, including the long calculations of cable invoices based on the fluctuating prices of copper and lead.

ELECTRICAL EXPORTS OF THE U.S.A.

BELOW are given the values (and quantities where available) of electrical machinery and appliances exported from the United States of America during 1919, showing the principal countries of destination. For purposes of comparison the figures for 1918 are added, and notes of increases or decreases are made.

	1918 Dol.	1919 Dol.	Inc. or Dec. Dol.
Batteries.—			
Total	3,178,000	5,998,000	+ 2,820,000
To Norway	131,000	212,000	+ 81,000
,, Great Britain	175,000	526,000	+ 351,000
,, Canada	1,087,000	1,780,000	+ 693,000
,, Cuba	162,000	276,000	+ 114,000
,, Argentina	148,000	377,000	+ 229,000
,, China	70,000	153,000	+ 83,000
,, Australia	308,000	412,000	+ 104,000
,, New Zealand	208,000	229,000	+ 21,000
,, British South Africa ...	150,000	311,000	+ 161,000
Carbons.—			
Total	1,601,000	1,392,000	− 209,000
To Italy	158,000	45,000	− 113,000
,, Norway	50,000	101,000	+ 51,000
,, Great Britain	123,000	83,000	− 40,000
,, Canada	778,000	759,000	− 19,000
,, Japan	179,000	73,000	− 106,000
Dynamos or generators.—			
Total	3,363,000	5,800,000	+ 2,437,000
To France	604,000	782,000	+ 178,000
,, Italy	33,000	344,000	+ 311,000
,, Norway	102,000	141,000	+ 39,000
,, Great Britain	96,000	92,000	− 4,000
,, Canada	522,000	775,000	+ 253,000
,, Mexico	45,000	135,000	+ 90,000
,, Cuba	100,000	368,000	+ 268,000
,, Argentina	45,000	111,000	+ 66,000
,, Brazil	61,000	157,000	+ 96,000
,, Chile	287,000	66,000	− 221,000
,, Uruguay	3,000	131,000	+ 128,000
,, China	136,000	314,000	+ 178,000
,, India	105,000	146,000	+ 41,000
,, Japan	401,000	1,054,000	+ 653,000
,, Australia	90,000	156,000	+ 66,000
Fans.—			
Total No. ...	54,600	76,500	+ 21,900
,, $ ...	847,000	1,421,000	+ 574,000
To Canada, No.	14,000	22,000	+ 8,000
$	121,000	289,000	+ 168,000
,, Argentina, No.	1,800	5,000	+ 3,200
$	26,000	91,000	+ 65,000
,, China, No.	8,000	12,000	+ 4,000
$	196,000	278,000	+ 82,000
,, British India, No. ...	15,600	12,600	− 3,000
$ ...	245,000	322,000	+ 77,000
Heating and cooking apparatus.—			
Total	686,000	1,580,000	+ 894,000
To Norway	125,000	274,000	+ 149,000
,, Great Britain	2,000	107,000	+ 105,000
,, Canada	242,000	314,000	+ 72,000
,, Argentina	38,000	95,000	+ 57,000
,, Japan	5,000	96,000	+ 91,000
Insulated wire and cables.—			
Total	5,605,000	8,815,000	+ 3,210,000
To Belgium	—	116,000	+ 116,000
,, Denmark	3,000	230,000	+ 227,000
,, France	383,000	135,000	+ 248,000
,, Netherlands	—	473,000	+ 473,000
,, Norway	163,000	1,671,000	+ 1,508,000
,, Portugal	22,000	110,000	+ 88,000
,, Spain	295,000	107,000	− 188,000
,, Sweden	—	139,000	+ 139,000
,, Great Britain	251,000	258,000	+ 7,000
,, Canada	181,000	198,000	+ 17,000
,, Mexico	301,000	340,000	+ 39,000
,, Cuba	615,000	550,000	− 65,000
,, Argentina	354,000	691,000	+ 337,000
,, Brazil	564,000	979,000	+ 415,000
,, Chile	496,000	300,000	− 196,000
,, Peru	127,000	144,000	+ 17,000
,, Uruguay	106,000	278,000	+ 172,000
,, China	126,000	311,000	+ 185,000
,, British India	33,000	192,000	+ 159,000
,, Dutch East Indies ...	282,000	292,000	+ 10,000
,, Australia	444,000	128,000	− 316,000
,, Philippine Islands ...	142,000	291,000	+ 149,000
,, British South Africa ...	53,000	233,000	+ 180,000
Interior wiring supplies and fixtures.—			
Total	1,429,000	2,319,000	+ 890,000
To Norway	28,000	107,000	+ 79,000
,, Canada	329,000	493,000	+ 164,000
,, Mexico	72,000	153,000	+ 81,000
,, Cuba	179,000	221,000	+ 42,000
,, Argentina	107,000	154,000	+ 47,000
,, Brazil	73,000	247,000	+ 174,000

	1918 Dol.	1919 Dol.	Inc. or Dec. Dol.
Metal filament lamps.—			
Total No. ...	14,585,000	17,072,000	+ 2,487,000
,, $ ...	3,369,000	4,674,000	+ 1,305,000
To Italy, No.	210,500	583,000	+ 372,500
$	43,000	198,000	+ 155,000
,, Canada, No.	2,422,000	3,061,000	+ 639,000
$	582,000	902,000	+ 320,000
,, Mexico, No.	941,000	1,632,000	+ 691,000
$	223,000	352,000	+ 129,000
,, Cuba, No.	1,702,000	984,000	− 718,000
$	437,000	310,000	− 127,000
,, Argentina, No.	1,860,000	1,424,000	− 436,000
$	454,000	448,000	− 6,000
,, Brazil, No.	2,375,000	2,987,000	+ 612,000
$	464,000	687,000	+ 223,000
,, Australia, No.	882,000	956,000	+ 74,000
$	188,000	232,000	+ 44,000
,, British South Africa, No.	443,000	489,000	+ 46,000
$	89,000	127,000	+ 38,000
Lamps, arc	14,000	17,000	+ 3,000
,, *carbon filament* ...	103,000	203,000	+ 100,000
Magnetos, spark plugs, &c.—			
Total	2,750,000	3,035,000	+ 285,000
To Italy	673,000	526,000	− 47,000
,, Great Britain	485,000	195,000	− 290,000
,, Canada	543,000	633,000	+ 90,000
,, Argentina	113,000	128,000	+ 15,000
,, India	53,000	101,000	+ 48,000
,, Japan	32,000	180,000	+ 148,000
,, Australia	143,000	278,000	+ 135,000
Meters and measuring instruments.—			
Total	1,888,000	2,891,000	+ 1,003,000
To Canada	249,000	402,000	+ 153,000
,, Argentina	153,000	208,000	+ 55,000
,, Brazil	147,000	327,000	+ 180,000
,, China	37,000	136,000	+ 99,000
,, Japan	432,000	639,000	+ 207,000
Motors.—			
Total	8,225,000	10,635,000	+ 2,410,000
To France	443,000	591,000	+ 148,000
,, Great Britain	1,622,000	877,000	− 745,000
,, Canada	1,455,000	1,611,000	+ 156,000
,, Mexico	296,000	428,000	+ 132,000
,, Cuba	499,000	505,000	+ 6,000
,, Brazil	146,000	544,000	+ 398,000
,, China	164,000	443,000	+ 279,000
,, India	574,000	572,000	− 2,000
,, Japan	800,000	1,068,000	+ 268,000
Rheostats and Controllers.—			
Total	289,000	515,000	+ 226,000
Switches and accessories.—			
Total	2,195,000	3,565,000	+ 1,370,000
Telegraph apparatus.—			
Total	379,000	831,000	+ 452,000
To Great Britain	107,000	200,000	+ 93,000
,, Canada	106,000	198,000	+ 92,000
,, Japan	63,000	97,000	+ 34,000
Telephones.—			
Total	2,687,000	3,783,000	+ 1,096,000
To France	140,000	197,000	+ 57,000
,, Italy	151,000	204,000	+ 53,000
,, Netherlands	—	157,000	+ 157,000
,, Norway	160,000	189,000	+ 29,000
,, Spain	34,000	167,000	+ 133,000
,, Great Britain	113,000	233,000	+ 120,000
,, Canada	283,000	678,000	+ 395,000
,, Brazil	553,000	380,000	− 173,000
,, China	75,000	158,000	+ 83,000
,, Australia	446,000	182,000	− 264,000
,, New Zealand	98,000	132,000	+ 34,000
Transformers.—			
Total	3,528,000	3,788,000	+ 260,000
To France	768,000	194,000	− 574,000
,, Italy	37,000	224,000	+ 187,000
,, Netherlands	9,000	144,000	+ 135,000
,, Spain	421,000	230,000	− 191,000
,, Mexico	136,000	235,000	+ 99,000
,, Brazil	195,000	538,000	+ 343,000
,, Chile	194,000	241,000	+ 47,000
,, China	201,000	193,000	− 8,000
,, Japan	300,000	366,000	+ 66,000
,, Australia	232,000	273,000	+ 41,000
All other electrical machinery and appliances (except locomotives) ...	17,846,000	27,827,000	+ 9,981,000
Grand total of electrical machinery and appliances (except locomotives) ...	59,984,000	89,090,000	+29,106,000

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR OCTOBER, 1920.

The October returns of electrical business show considerably increased values in the export section as compared with the previous month, the figures being £1,321,252, as compared with the September total of £1,145,191. This excellent result is largely accounted for by the increase in telegraph and telephone exports of £140,000, electrical goods £25,000, and carbons £18,000, a falling off occurring in the export values of insulated wire (£14,000), and meters (£7,000), whilst electrical machinery exports remain stationary at £270,000.

For comparison, we give the figures showing the exports of electrical goods and apparatus and electrical machinery for the first 10 months of 1913, 1919, and 1920 :—

	1913.	1919.	1920.
Electrical goods & apparatus, June to October.	£4,121,152	£4,392,234	£9,046,006
Electrical machinery, January to October.	1,872,028	1,487,533	1,878,525
	£5,993,180	£5,879,767	£10,924,531

Imports of electrical goods and machinery for the month of October totalled £432,439, as compared with £298,382 for September, an increase of £134,000 ; increased import values are recorded in electrical machinery, £80,000 ; telegraph and telephone cable and apparatus, £12,000 ; batteries, £23,000 ; and carbons, £14,000 ; the total of electrical imports for the 10 months January to October, 1920, is £2,316,386, as against £1,645,423, and £2,400,538 for the corresponding periods in 1919 and 1913 respectively.

Re-exports of Foreign and Colonial electrical material amounted to £22,902, as against £20,398 for the previous month.

Values of Electrical Exports and Imports for October, 1920.

	Exports.	Imports.	Re-exports.
Electrical goods and apparatus (unenumerated)	£225,622	£100,757	£4,552
Insulated wire	312,657	19,142	84
Glow lamps	40,236	10,480	3,675
Arc lamps and parts	1,711	1,159	289
Batteries	71,904	33 791	1,116
Meters	31,402	9,017	3,669
Carbons	26,912	24,117	665
Electrical machinery :—			
Railway and tramway motors ...	877	—	—
Other motors and generators ...	176,146	—	—
Electrical machinery (unenumerated)	85,456	197,123	8 247
Switchboards (not telegraph or telephone)	7,818	216	—
Telegraph and telephone cable and material :—			
Telegraph and telephone wire and cable (not submarine) ...	81,521	2,496	—
Submarine telegraph and telephone cable	144,411	—	—
Telegraph and telephone instruments and apparatus	114 579	34,141	105
Totals... ...	£1,321,252	£432,439	£22,902

Italian Electrical Industry.—The progress which the Italian electrical industry is making in recent years is shown by statistics compiled by the Associazione fra Esercenti Imprese Elettriche (Association of Working Electrical Undertakings), based upon returns made by those companies. The capital invested by companies purely electrical, from July, 1914, to July, 1919, came to over 757,000,000 lire, rising from 8,000,000 lire in the second half-year of 1914 to 114,000,000 lire in the first half of 1919. Completed by statistics down to October of the last-named year, the following table exhibits the number of working companies and the capital invested in each of the provinces of Italy :—

	No. of companies.	Capital invested, lire.		No. of companies.	Capital invested, lire.
Piedmont	31	122,394,500	Lazio	24	117,300,000
Lombardy	94	536,811,995	Abruzzi & Molisa..	8	2,297,000
Veneto	24	120,268,000	Campania	30	133,260,055
Liguria	17	168,830,000	Pugile	12	8,454,000
Emilia	8	26,700,000	Calabria	11	6,266,000
Tuscany	23	132,495,700	Sardinia	1	120,000
The Marches ..	12	12,565,000	Sicily	9	4,430,793
Umbria	3	1,900,000	Totals ..	306	1,458,093,286

Swiss Aluminium.—Its wealth in hydroelectric power has made Switzerland one of the principal producers of aluminium. In 1918 that country exported 10,500 tons of raw aluminium, to a value of 51,000,000 fr. To the figures stated must be added 2,000,000 fr. of bar and sheet aluminium, 6,500,000 fr. of technical appliances, and 3,200,000 fr. of other articles in aluminium. With the end of the war in 1919, the export of aluminium technical articles fell off, while that of household items was doubled. The latter exports rose to a value of 6,200,000 fr., of which one-fourth went to Italy, and one-fifth to France. The Scandinavian countries only took 900,000 fr. worth of these goods, and Spain 300,000 fr.

LEGAL.

A Street Box in Collision.

Justices Rowlatt and McCardie, in the King's Bench Divisional Court on November 12th, had before them appeals by Mr. Alfred Hawdon, baker, of Stockton Road, Sunderland, and Mr. John V. Thompson, of Boughton Street, Sunderland, against a judgment of his Honour Judge Moore at Sunderland County Court in favour of the Sunderland District Electric Tramways, Ltd. The action was brought by the company against both appellants for damages in consequence of injury to a street electric box while Thompson was towing with his lorry a disabled motor van belonging to Rawdon and steered by his roundsman. Appellants contended that there was no evidence of negligence to support the judgment. Without calling upon counsel for the respondent company their Lordships dismissed both appeals, on the ground that the Judge was right in holding that both defendants were negligent.

Extension of Patents.

In the Chancery Division on Wednesday Mr. Justice Sargant granted an application by Mr. Henry Stafford Hatfield and the Reason Manufacturing Co., of Lewes Road, Brighton, for an extension of two patents, Nos. 20,500 and 20,770, of 1905, the former relating to "improvements in mercury electrolytes for electrolytic cells" and the latter to "improvements in cathodes." Sir A. Colefax, K.C., who appeared with Mr. Whitehead for the applicants, said the ground of the application in the case of each patent was that the applicants had suffered loss and damage by reason of the war interfering with the working of the patent. There was no opposition by the Board of Trade to an extension. His Lordship extended the patents for four years from the date of expiry in 1919.

Charges Dismissed.

Haslingden magistrates, on November 8th, dismissed charges of forgery and false pretences brought by the Postmaster-General against Mr. Barnes Kay, manager of the Haslingden Corporation Tramways.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The I.E.E. Subscriptions.

I hope that the members present at the I.E.E. meeting called for December 2nd will thoroughly explore the Council's reasons for the proposed increase of subscriptions. I hope they will ask whether the possession of the Embankment building is a paying proposition in these post-war days.

Do we really need the building, and, if not, is the present a favourable time for selling it and taking a smaller building or suite of rooms?

Was the building used to any great extent as a club by London or country members before it was taken over by the Government? If the London members use the building as a club, should they not pay a higher subscription than country members?

As a country member, the building is of little service to me, and I suppose about 70 per cent. of the members live outside the London area.

As a means of saving expense I suggest that all papers read before the Institution on telegraphs and telephones, both wireful and wireless, should be sent only to those members who ask for them. I only take telegraphs and telephones as an illustration of my point, which is, that in these days of specialisation there is a lot of matter published in the *Journal* which is only read by the specialist, but all this matter is posted indiscriminately to every member.

I am asked to pay £1 2s. 6d. per annum extra, and I submit that it would have cost far less than £1 2s. 6d. per member for the Council to have printed and posted to each member the "full statement" of the Council's case. The proxy voting is an unsatisfactory arrangement, and I hope the members at the meeting will demand that a questionnaire formulated by them shall be posted to each member. Foreign members would, of course, receive the questionnaire.

Lastly, I would ask if the Institution is considering questions of "status and compensation" on the lines of the article in your issue of October 29th? It is reasonable that there should be both oculists and dentists, but it is expensive when an electrical engineer on the "salariat" must subscribe to one society to get "status" and to other societies *in the hope* of getting "compensation."

Country A.M.I.E.E.

November 10th, 1920.

A good number of members of the I.E.E. may be complaining about the increased subscriptions now asked for.

It is, however, my opinion that the members wherever practically possible would have done well to have compounded for their annual subscriptions years ago.

The I.E.E. is the parent electrical institution, and I consider that there are at present too many smaller branch institutions, which may have doubtful usefulness.

London. **D. R. Broadbent.**

November 15th, 1920.

It is quite clear that the proposal contained in the circular issued by the Institution on the 4th inst. should, for reasons it is not desirable now to discuss, be opposed.

It is equally clear that the only opportunity afforded by the Council for those who cannot attend the meeting on December 2nd to oppose the recommendations, is to send their proxy papers to some member who can attend the meeting, and is likewise opposed to the proposals.

As I propose to attend the meeting, I shall be agreeable to receive the proxy papers of those members who would desire me, on their behalf, to use their vote in opposition to the Council's proposals, and at the same time I shall be glad to have any comments from such members on the matter.

Fredk. W. Purse.

84 and 86, Romford Road,
Stratford, E. 15.
November 13th, 1920.

Cheap Wiring for Small Houses.

The announcement in your current issue that the price to be paid for the lighting installations for the Hythe housing scheme is 28s. 6d. per point raises questions of some importance.

In the first place, it will be interesting to hear the opinions of wiring contractors as to the possibility of satisfactory work being done at this figure. I have before me a copy of the specification for this work, and from this it appears that there are to be seven points in each house. The wiring is to be "laid in steel conduit tubing with the necessary solid (not split) elbows, bends, tees, &c., and with slip joints." "All connections to be properly formed to ensure continuity throughout." "The whole to be formed in two circuits with a proper distribution-board with fuses to control each circuit." "All distribution-boards to have ordinary 5-amp. cut-outs." Each house to have a D.P. main switch and a pair of fuses, and each point is to be complete with a H.V. metal-filament lamp and an opal shade.

Although believing that much might be done to reduce installation costs by the withdrawal of many unnecessary "rules" and restrictions, I quite fail to see how this specification can be complied with under present conditions at 28s. 6d. per complete point.

The second question raised by this contract is the responsibility for the design of the installation by a competent electrical engineer. It will have been noticed from the above that the tubing is to be "slip socket," and that continuity is to be obtained. The attention of the Borough Surveyor, who issued the specification, was drawn to this point by an inquiry as to the grip fittings to be used. He replied: "Surely it is possible even with slip joints to ensure continuity throughout. There is no intention of using grip fittings, as this will considerably increase the price."

If this absurd specification is a fair specimen of the working of the Hythe housing scheme or of that of any other town, these houses will be truly "homes for heroes"—indeed, it will need a hero to inhabit one!

E. A. Pinto.

Ramsgate,
November 10th, 1920.

Shop Lighting.

Referring to your note on this subject, with some twenty-two years in contracting experience, my opinion is that the contracting firms are not so much to blame as the proprietors themselves. An enormous amount of time is given to soliciting orders and advising on the best means for lighting shop windows, but it is on few occasions that the advice is taken, the question with the shop-keeper being not which is the most efficient lighting, but which is the cheapest. Most tradesmen are prepared to discuss the best means of lighting, but few are prepared to pay for it. Your correspondent goes on to say "that the electrical retail trade has not yet learned the first lessons in salesmanship." This I do not agree with. For some years I kept, in a private house just off the main road, a show-room well equipped with fittings, heating and cooking apparatus, electric motors, &c., backed up by about £2,000 worth of electrical stock; I did good business, not with the people who came in casually, but with the people I brought into the show-room by various methods. I then purchased premises in the main road, and spent quite a good sum of money in fitting up the show-room, and had a good window display, but on reviewing the turnover one found that the extra business done did not warrant the

expense. I therefore restocked the premises with other lines and made electrical goods less prominent. My experience has been in the suburbs of London, and, speaking from that point of view, I contend that a properly equipped show-room in a main road does not pay for itself, but it can be made to pay if carried out in inexpensive premises off a main road, provided that the contractor is sufficiently active to draw in clients.

Where orders are continually given only to the lowest estimate, it stands to reason that the man with big premises and show rooms cannot stand up against the firms working in the back yard.

The industry would be in a different position altogether if the wholesale firms kept strictly to supplying the trade, but one comes against numerous cases where fittings, lamps, and other accessories are sold at wholesale prices through all sorts of weird and wonderful channels. At the present time I do not know of a motor firm that is properly supporting the wholesale trade. I am every day meeting cases where the quotations given to people outside the line are the same as those I receive myself. Unless the contractors will properly band themselves together with some really live organisation, I am afraid these conditions will continue to exist, and the much-desired purely electrical shop where everything electrical can be seen and demonstrated under ideal conditions cannot exist.

November 9th, 1920. **The Retailer.**

A Large Totally-enclosed Dynamo.

Referring to the above article in the current issue of the Electrical Review, as the concluding remarks may be somewhat misleading; I should like to state that Lo-Thermo, Ltd., is a distinct firm formed for the purpose of granting licences for enclosed dynamo electric machinery fitted with heat dissipators—one type of which was described in the article.

Furthermore, my firm hold a licence to manufacture this class of machinery.

Newtons, Ltd.

Taunton. H. N. Hickley,
November 16th, 1920. *Managing Director.*

["A Life-long Reader" has omitted his name and address from his letter.—Eds. Elec. Rev.]

THE PHYSICS AND CHEMISTRY OF COLLOIDS AND SOME INDUSTRIAL APPLICATIONS.

Faraday Society and Physical Society Discussion.

We have already made brief reference to the symposium and general discussion on colloids held on October 25th in the hall of the Institution of Mechanical Engineers, under the auspices of the above societies. Seeing that the meeting lasted from 2.30 in the afternoon to nearly 11 o'clock at night—with the necessary intervals reduced to a minimum—and covered a bewilderingly large field, it will be impossible here to give an adequate account of the proceedings. We propose, however, to draw attention just to two or three salient features of the discussion, dealing more particularly with points of physical interest and such industrial applications as were referred to by way of illustration.

When it is remembered that all living beings, most of our food and clothing, and innumerable substances of everyday use and importance, from glue and starch to bricks and mortar, are made up, or largely made up, of colloidal matter, the importance of the study of colloids will be at once appreciated.

The survey of our present knowledge of the subject, and especially of its physics, given by Prof. The Svedberg, who came from Upsala for the purpose, was an admirable exercise in precise statement based on wide and exact knowledge. The science of colloids was well-defined as the science of the micro-structure of matter, the domain between macroscopic and molecular dimensions. One should speak of the colloidal state rather than of colloids. The definition led directly to a review of the methods of inducing the colloidal state; dispersion when from matter in the macroscopic form, condensation from matter in the molecular or infra-microscopic form. An important example of the former process, which obviously involves doing external work against surface tension forces, and therefore absorbs energy, is the emulsification of fats or hydrocarbons. The process may be facilitated by the addition of agents, such as soap, which lower surface tension. Another method is a combination of grinding with the addition of agents that prevent aggregation. An example of the condensation method is afforded by the well-known method of producing colloidal metals by arcing under a liquid; such condensation needs the presence of nuclei, which may be ions.

Dr Svedberg proceeded to review the methods of studying the structure of colloids, such as microscopic and ultra-microscopic examination with accompanying measurements, behaviour in magnetic and electric fields, optical methods, such as the absorption, scattering, or polarisation of light, viscosity measurements, and by means of the absorption of charged ions. The effect of the addition or removal of ions in causing aggregation or disaggregation was reduced to the form of a simple mathematical theory.

The section on emulsions was opened by Prof. F. G. Donnan, C.B.E., F.R.S., who defined an emulsion as a system in which one liquid is dispersed in the form of small globules. The importance of emulsions from the theoretical standpoint results from the light they throw on many colloidal phenomena, for the electric double layer which forms round the globules and prevents coalescence gives to a pure emulsion all the properties of a very stable suspension colloid on a somewhat rough scale. Discussion largely centred round the inversion of emulsions, when on the further addition of the dispersed liquid the latter exchanges its rôle with the liquid which was previously the continuous medium. Electrolytes play an important part in this phenomenon of reversal of phases. Mr. S. S. Bhatnagar contributed a study of reversal due to the action of ions. He drew a parallel between this power of cations and their precipitating power on suspensions which was much criticised by subsequent speakers. The practical aspect of the subject was emphasised by Mr. W. Clayton, who spoke on emulsion problems in margarine manufacture, which, he said, offered a splendid field for colloid research. Prof. Svedberg drew attention to the case of emulsions of mercury and water and mercury and oil, which were of interest on account of the high surface tension of the one phase. The mercury could constitute either the disperse or continuous phase.

Mr. Emil Hatschek initiated discussion on physical properties of elastic gels, which showed how greatly divided opinion is on the structure of jellies, and how little we really know about it. Prof. Procter's solid solution theory is not a convincing picture of a substance containing, say, 99 per cent. water, which yet behaves like an elastic solid! And what is one to make of an extraordinary experiment described for the first time by Mr. Hatschek, in which after straining a gelatin prism for five days, the stress was found to disappear, but the optical anistropy caused by the strain remained. The discussion emphasised the complications introduced into a gel such as gelatin, which has been almost exclusively experimented with, by the necessary presence of an electrolyte—water. It was thought that a better approach to this section of the subject would be through non-aqueous gels—for example, rubber gels—which have been almost entirely neglected. Prof. J. W. McBain, however, claimed that recent studies of soap solutions throw considerable light on gel structure. The fact that the same solution of sodium oleate could be made to assume either a sol, gel, or opaque curd form, seemed to him to overthrow entirely the favourite cellular conception of gel structure and substitute a micellar structure theory which regards the colloidal particles as being identical in sol and gel, but as independent in the former and linked up in the latter. This view was supported by independent evidence put forward by many speakers, and most strikingly of all in an experiment described by Prof. Svedberg, in which a cadmium sol in a non-aqueous medium is found to set to a jelly on the oxidation of the cadmium. Touch it with a glass rod, however, and it at once reverts to the liquid form.

Bare reference must suffice to the next two sections of the discussion. Sir Herbert Jackson, in a chatty discourse crowded with highly-interesting but little-known facts, and devoid of all pretensions to theory, talked about glass, the colloidal character of which he doubted because it can be made quasi-crystalline, and coloured glasses, some of which are undoubtedly in the nature of colloidal suspensions. Sir Herbert succeeded in convincing everyone of the extraordinary interest and fascination of this subject, which deserves much more attention than it has up to the present received from investigators. Somewhat different views were stated by Dr. M. W. Travers, who quoted recent experiments on the viscosity of molten glass, which lent undoubted support to the colloid theory.

Discussion on non-aqueous colloidal systems, the great importance of which to an understanding of colloids has already been referred to, was opened by Sir Robert Robertson, who dealt exclusively with nitrocellulose, and continued by Mr. F. Sproxton. This substance derives its importance from its applications to celluloid, artificial silk, explosives, and other derivatives, and on this account it has been somewhat extensively studied, particularly as regards the viscosity of its solutions in organic solvents, ether, alcohol, and so forth. The relations established between viscosities of the solutions and the mechanical properties of the dried colloid, enable the manufacturer to control the latter, but the rationale of the relationship is hardly understood as yet. Even more complex is the colloid chemistry of solid celluloid, the manufacture of which from nitrocellulose is the gradual transformation of a gel to a solid. Mr. B. D. Porritt dealt with the allied subject of rubber, and described experiments on the sol-gel transformation—in other words, its deterioration—produced in rubber solutions by light and oxygen, the latter acting as a catalyst. Dr. E. H. Rayner remarked in this connection on the variation of resistance of ebonite due to the action of light. It appears that the sulphur in the ebonite becomes oxidised to sulphuric acid, and it has happened that the resistance of a standard coil has from this cause been known to become reduced to one-tenth of its true value.

BUSINESS NOTES.

Bankruptcy Proceedings.—Harrison & Son, electrical engineers, 93, Princes Street, Southend-on-Sea, Essex.—The first meeting of the creditors was held on November 9th at the offices of the Official Receiver, 14, Bedford Row, London, W.C.1. The statement of affairs showed gross liabilities £916, of which £665 was expected to rank, while no assets were disclosed. A creditor, stated to be fully secured, held a bill of sale for £250 over the stock-in-trade, fixtures, and fittings. A meeting of the debtor's creditors appeared to have been held on October 2nd at the office of his solicitors, when an offer was made of 10s. in the £, payable by two instalments, but was not accepted. It was decided to leave the matter in the hands of the Official Receiver.

G. W. Lester (Lester & Browne), wholesale electrical engineer, formerly trading at 44-6, Surbiton Road, Kingston, under the style of Lester & Browne. The first meeting of creditors was held at the London Bankruptcy Court on November 15th. Mr. F. T. Garton, Official Receiver, reported that no accounts had yet been lodged, but the debtor roughly estimated his liabilities at £1,200, and had no assets. The debtor attributes his failure and insolvency to trading losses, to a further loss of £150 on horse races during the last 12 months, and to family illness. In the absence of any offer, the case was left with the Official Receiver to be wound up in bankruptcy.

W. H. S. Ward, electrical engineer, 56, High Street, Acton, W. First meeting November 23rd at 14, Bedford Road, W.; public examination, December 7th, at the Court House, Brentford.

Company Liquidations.—Rex Accumulator Co., Ltd.—A meeting of members is called for December 14th, at Dashwood House, New Broad Street, E.C., to hear an account of the winding up from the liquidator, Mr. M. Leggett.

Submarine Motor Ship Cleaner Syndicate, Ltd.—Petition presented to the High Court, July 1st. Winding up order made November 9th.

Foote & Milne, Ltd.—Winding-up voluntarily. Liquidator, Mr. R. J. Ward, 10, Serjeants' Inn, E.C. Meeting of creditors, November 24th, at Anderton's Hotel, Fleet Street, E.C. Particulars of claims to be sent to the liquidator by November 20th.

Electric Chemical Developments, Ltd.—Meeting of creditors, November 25th, at 66, London Wall, E.C.

Trade Announcements.—The Enterprise Manufacturing Co., Ltd., has removed the Glasgow branch to more convenient premises, at 47, Oswald Street, Glasgow. Telephone number, Central 2526; telegraphic address, "Unopposed, Glasgow."

Holland House Electrical Co., Ltd., has recommenced business at 58, West Regent Street, Glasgow. Mr. H. Watson will be in charge of the company's business as managing director and secretary. Telephone, Douglas 1360; telegrams, "Electrical, Glasgow."

Messrs Sinclair, Paget & Co., Ltd., electrical engineering specialists, Espeaco Works, New Inn Yard, Shoreditch, announce that having completed extensive structural alterations and enlargement of premises, they are in a position to execute repairs to dynamos, motors, &c., at short notice, owing to the large stocks of all sizes of wire held.

Mr. H. J. Read, M.I.E.E., who severed his connection with Messrs. Edmundsons' Electricity Corporation in March last, after a service of over 30 years, has joined forces with Mr. H. J. Butcher, A.M.I.E.E., and Mr. W. J. Bransom, A.M.I.E.E., who were on the staff of Messrs. Edmundsons' for 30 and 20 years respectively, and Mr. D. Dunham, B.Sc., recently in the service of the British Thomson-Houston Co., Ltd. Under the title of Read & Partners, Ltd., they are specialising in electrical installations for country houses, farms, works, &c., their address being 53, Victoria Street, Westminster. Telephone, No. 8084 Victoria. Mr. Jas. Garnett, who was for over 30 years with Messrs. Edmundsons', has joined the staff of the new company.

Mr. W. Barrett, manager of the Kingswood Engineering Works, Bristol, is commencing business as an electrical contractor at 86, Third Avenue, Bath, under the style of Barrett & Blake, and will be pleased if manufacturers will send catalogues of electrical goods.

Messrs. Millikin Bros. Manufacturing Co. (Inc.), have removed their offices to Amberley House, Norfolk Street, Strand, W.C. 2. Telephone, City 5814.

Messrs. Stephen Glover & Co., engineers, have removed from 12, Eldon Square, to 13, Akenside Hill, Quayside, Newcastle-on-Tyne. Telegrams, "Apparatus, Newcastle-on-Tyne"; telephone, 153 City.

Catalogues and Lists.—Atlas Carbon and Battery Co., Ltd., 19, Ewer Street, E.C.—Two leaflets illustrated in colours, dealing respectively with "Atlas" porous pots, and "Sovereign" and "Dania" dry cells.

Huntalite, Ltd., 25, Newman Street, W.1.—A priced and illustrated booklet (8 pp.) dealing with "wireless" reflectors for shop lighting, &c., and "Huntalite" electric candle lamps. Also two illustrated leaflets dealing with these matters.

Carron Co., Falkirk.—A show-card (18 in. × 13 in.) bearing the title "The Cosy Comfort of a Carron Electric Fire," and a reproduction of a water-colour drawing of a mother and child whose faces are illuminated by a cheerful glow.

The British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, E.C.4.—A small folder giving prices and illustrations of "Mazda" vacuum and gas-filled lamps, and "Stages in 'Mazda' Progress."

Also a blotter in the form of a card bearing a reversed advertisement of "Mazda" lamps, to be read by holding the card in front of a mirror.

J. H. Sankey & Son, Ltd., 74, Cheapside, E.C.2.—A list of temperatures, melting, freezing and boiling points, &c., ranging from the temperature of the sun to absolute zero, with a coloured chart for rough estimation of temperatures. On the reverse Sankey's fire-bricks, fire-clay, &c., are advertised.

E. P. Allam & Co., 107-109, Gray's Inn Road, W.C. 1.—Monthly stock list of D.C. motors for sale and hire, ranging from ¼ to 50 H.P., new and secondhand.

British Insulated & Helsby Cables, Ltd., Prescot, Lancs.—A leaflet (4 pp.) giving sizes and prices of aluminium wire, strip and sheet, with comparative figures for copper.

The Falcon Iron Works, Ltd., Oldham.—An illustrated booklet (71 pp.) dealing with numerous types of electrically-driven hauling and winding plant, principally for colliery work. Agent, W. M. Harris-Burland, 63, Queen Victoria Street, E.C. 4.

R. A. Evans, Ltd., Prospect Road, Leicester.—A well illustrated description (12 pp) of lift engines, cars, switchgear, &c.

The British Thomson-Houston Co., Ltd., Rugby.—Descriptive List No. 1,160 (92 pp.). An interesting and minutely detailed brochure dealing with turbo-compressors, blowers and exhausters. With numerous diagrammatic and photographic illustrations.

The A. & A. Electrical Co., Ltd., 13, Farringdon Road, E.C. 1.—An illustrated and priced leaflet giving details of electric fires, irons, boilers, hot-plates, &c.

The Galvanizing Equipment Co., Ltd., 29A, Portpool Lane, Gray's Inn Road, E.C. 1.—A well-illustrated booklet (23 pp) giving examples of applications of the firm's method of galvanising to various types of fittings, &c.

The Falkirk Iron Co., Ltd., Falkirk.—A new series of leaflets, No. 219, illustrating the "Falco" electric cooker; No. 230, domestic electric appliances; and No. 235, electric fires and heaters. All fully priced.

Fraser & Chalmers' Engineering Works, Erith, Kent.—Illustrated leaflet (F and C 2,367) dealing with the manufacture of electrically-welded fire-proof doors.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 4.—Illustrated and priced leaflet (H 2,372) dealing with the "Ideal" electric log fire.

Jordan & Sons, Ltd., 13, Broad Street Place, Liverpool Street, E.C. 2.—Two leaflets describing steel office filing cabinets and transfer drawers. Dimensioned, illustrated, and priced. Also list of works on company law and practice.

T. Francis & Sons, 231, St. George's Road, Bolton.—An 8-page leaflet illustrating and describing hand-feed arcs, standard resistances, stage arc boxes, &c. Fully priced.

Electric Supplies Co., S.A., Barcelona. (Agents for "Wild-Barfield" electric furnaces).—An illustrated leaflet (E S. 50), in Spanish, describing "Wild-Barfield" furnaces and accessories.

Imports of Manufactured Goods.—In the House of Commons on November 8th, the President of the Board of Trade (Sir Robert Horne) replying to Mr. Remer (U., Macclesfield) said the value of the wholly or mainly manufactured goods imported from Germany during the first nine months of the following years was:—

1912	£36,400,000
1913	41,000,000
1919	43,000
1920	17,191,000

The figures for 1912 and 1913 are estimates based on annual totals, and during 1919 trade was permitted only as from July 12th.

Questioned as to the difficulty of British manufacturers competing against cheap foreign goods and as to whether he would consider the introduction of a Bill affecting the collapse of the exchange, Sir Robert Horne replied: "I am considering that very difficulty now."—*Financial Times.*

Foreign Trade.—October Figures.—The following are the values of imports and exports of electrical goods and machinery in October:—

	October, 1920.	*Inc. or dec.*	10 *months*, 1920 *Inc. or dec.*
	£	£	£
Imports.			
Electrical goods, &c. ...	235,316	+ 153,703	+ 287,086
Machinery	1,953,214	+ 677,747	+ 4,103,211
Exports.			
Electrical goods, &c. ...	1,058,773	+ 468,527	+ 4,653,722
Machinery	6,251,326	+3,004,584	+24,663,092
Re-exports.			
Electrical goods, &c. ...	14,655	+ 7,138	+ 34,002
Machinery	187,206	+ 80,898	+ 664,233

Mexican Trade Openings.—An article in the *Financier* gives the views of a leading Mexican merchant on the possibilities of trade with Mexico. He states that Germany and the United States are busily cultivating that market, which has immense potentialities. The Republic will shortly be recognised by the United States, and our trade rivals are laying plans for developing business on a large scale in the future. Owing to the vast oil and other mineral wealth of Mexico that country will become of great importance.

Lead Report.—Messrs. G. A. Cawson & Co., in their report dated November 13th say: Final prices are about 30s. to 40s. lower as follows: November, £34 10s. to £34 15s.; December, £34 to £34 5s.; January, £33 15s. to £34; February and March, £33 10s. to £33 15s. Prompt lead is scarce and difficult to obtain at £35 to £35 5s. The Board of Trade returns just issued show how serious the situation has become. Imports for the ten months to the end of October are only 122,787 tons, against 202,435 tons for the same time last year, showing a falling-off in supplies of 79,648 tons. The exports show a very large increase, the total of English and foreign lead for the ten months being 54,740 tons, against 24,106 tons last year. These figures combined show a total of 110,282 tons decrease in supplies for home consumption. It is not surprising, therefore, that practically the whole of the Government stock of 120,000 tons has disappeared. It also goes to show that the general consumption of lead has not declined. Even the small quantity still in warehouse is being drawn upon almost daily, and stocks will show a further decline at the end of the month. Supplies are still coming in very slowly, and there seems to be very little lead available. . . . The Australian strike is reported settled, but very little lead can reach this country for at least four to six months.

Trade with Canada.—Mr. F. W. Field, H.M. Trade Commissioner in Toronto, who is at present at the Department of Overseas Trade, prepared to interview firms interested in the extension of British trade with the Dominion, says: "There was never a better time for United Kingdom manufacturers to establish or strengthen their trade connections in Canada. While there is a temporary lull in demand there, this is likely to be of brief duration. Canadian importers are anxious to place their orders in the United Kingdom, and they can pay cash for most of their requirements. They have been compelled during recent years to purchase large quantities of merchandise in foreign countries, but there is an earnest desire to transfer this trade, as far as possible, to the United Kingdom, and to other parts of the British Empire.

"It is a mistake for United Kingdom manufacturers to believe that Canadian import trade is so largely in the hands of foreign countries, that British traders have little opportunity to extend business there. Canada is probably a more difficult market than are certain others, but it offers considerable scope for the development of British trade. It is necessary, however, to approach the market in the manner best suited to local conditions, having in view its geographical position, its extended area, and the competition likely to be met. The Department of Overseas Trade is in a position to advise United Kingdom manufacturers on these matters."

A Memorial Tablet. — On Armistice Day a bronze memorial tablet in honour of the 89 men from the English Electric Co., Ltd., Siemens' Works, at Stafford, was dedicated by the Bishop of Lichfield, in the presence of 2,500 persons. Mr. W. Parker, works manager, presided, and performed the unveiling ceremony, and the heads of the various departments were also present. Mr. Parker stated that when war broke out the undertaking was given that the dependents should be provided with such assistance as would keep them in reasonable comfort, and also that those who returned should be taken back into the service of the company; 834 men went and 520 returned, and the promise had been fulfilled. The tablet, erected in the vestibule of the main offices (and paid for by the employés at the works), bears the following inscription: "To the glory of God and in memory of the following brave men who gave their lives fighting for the cause of liberty in the Great War." Then follow the names of 89 men, giving ranks and regiments. The sounding of the "Last Post" and the "Réveillé" concluded the ceremony. Scrolls are being presented to all returned soldiers.

Cuba as an Electrical Market. — Considering the size of the island, 700 miles long by from 22 to 160 miles in width, with a population of nearly 2½ millions, the number of electric lighting stations is not at present large. They are, however, now being largely augmented, and it is in connection with the new plants and their equipment that opportunities for the introduction of British manufactures would be found. Importers here say that British electrical goods are well appreciated where they have been acquired, and inasmuch as similarly-priced manufactures from the United States are frequently several months in transit, and in some cases prove, when delivered, to be not according to specification, there should be an excellent opening for the products of other nationalities.

Cuba offers a particularly attractive field for small motors suitable for medium-sized factories, of which a considerable number have been commenced during the last few months when large sums of money had been gained through successful sugar speculation and general trade prosperity. The people are well accustomed to the use of machinery as well as to the employment of electrical power, while the comparative abundance of money (the strictures imposed by the recent moratorium are only likely to prove temporary) has until recently enabled purchasers to pay cash for their acquisitions. —*Reuter's Trade Service* (Habana).

New French Electrical Companies.—To specialise in the electric equipment of motor vehicles and aircraft L'Equipement Electrique de Puteaux has been formed at Paris, with a capital of 3,500,000 fr. Its works are at Puteaux, and its offices at 2, Avenue Velasquez, Paris.

The Société Electrique Koda has been formed at Paris (128, Rue de Faubourg St. Honoré) for the manufacture of electric pocket lamps, dry and wet cells, and electric mechanical appliances. Its capital is 1,000,000 fr.

L. Poulain et Cie has been registered a company at Paris (86, Rue de la Glacière), with a capital of 200,000 fr., for the trade in, and manufacture and repair of, electric apparatus.

With the title of Comptoir d'Electricité Franco-belge has been formed a company at Paris (19, Rue d'Athènes), with a capital of 100,000 fr., for the purchase and sale of electric apparatus.

The Société Commerciale des Industries Mécaniques has been constituted at Paris (3, Rue de Chaillot) to trade in electric, mechanical, and other machines required in agriculture, aviation, and in chemical products, heating apparatus, &c. Its capital is 300,000 fr.

There has been formed at Boulogne-sur-Seine (17, Rue Gambetta) the Compagnie Générale des Appareils Norvelectriques, with a capital of 1,200,000 fr., for the manufacture, purchase, sale, and installation of time measuring apparatus of all kinds, and especially the sale or licensing of patents for the Moulin-Favre-Bulle electric clocks.

L'Electricité Appliquée au Spectacle et à la Décoration is the name of a company started at Paris (85, Rue Pellaport), with a capital of 400,000 fr., to spread the use of electricity for decorative purposes.

There has been formed at Calais (67, Rue de Vic) the Société Industrielle d'Appareillage Electrique et Mécanique for the manufacture of electric and mechanical apparatus. Its capital is 40,000 fr.

Under the style of Massardo et Cie a company has been embodied at Gentilly (Seine) (17, Rue Barré) for the manufacture of electric appliances. Capital 80,000 fr.

At Roubaix (75, Rue Nain) has been established the Société Auxiliaire de l'Agriculture et de l'Electricité, with a capital of 1,500,000 fr., for the promotion of the use of electricity in agriculture.

At La Varenne St. Hilaire (Seine) has been formed a company under the style of C. L. Falconet, Heller et Cie, for the manufacture of copper gauze used in electric machine construction. Its capital is 180,000 fr.

Under the style of the Anciens Etablissements Saintville has been launched a company at Paris (42, Boulevard de la Bastille) whose objects are the production and use of electricity for heating and other purposes. Capital 166,400 fr.

The following increases of capital have been sanctioned: Société Industrielle des Telephones, from 18,000,000 to 36,000,000 fr.; Société Versaillaise d'Electricité et de Tramways Electriques, from 3,000,000 to 10,000,000 fr.; Compagnie Generale de Télégraphie et de Téléphonie, from 1,500,000 to 5,000,000 fr.; Les Fabricants Electriques, from 800,000 to 1,100,000 fr.; the last two increases have been just realised.

An extraordinary meeting of the Energie Industrielle, held on October 18th, has given its approval to the schemes of amalgamation arranged with the Société Francaise d'Exploitation Electrique and the Société Electrique de l'Orléannais, and appointed MM. Lanier and Fourrier to make a valuation of those companies' assets. It is proposed to exchange one share in the Energie Industrielle for two shares of the amalgamated companies, 279 shares being thus apportioned to the former, and 1,181 shares to the latter company. The capital of the Energie Industrielle will, therefore, be raised to 20,000,000 fr., divided into 200,000 shares of 100 fr. each. A very satisfactory account of this company's various operations, especially in Madagascar, was given.

British Trade Mark Applications. — Appended is a summary of the recent applications for British trade marks in respect of goods associated with the electrical industries and trades:—

Astra, No. 404,942, Class 6.—Electrical machinery and parts. Astra Dynamo Co., 110, Victoria Street, Westminster, S.W., June 7th, 1920.

L.N.S., No. 407,221, Class 5.—Electrolytic copper. Nichols Copper Co., 25, Broad Street, New York. August 24th, 1920.

Magnet, No. 406,073, Class 18.—Electric heating and cooking apparatus. General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C. July 14th, 1920.

W. J. Electric Tools (lettering combined with design), No. 404,385, Class 6.—Electric tools. White, Jacob & Co., Ltd., 48-56, Bayham Place, Camden Town, N.W. May 21st, 1920.

Memco, No. 404,808, Class 13.—Electric switches, fuses, and cut-outs. Midland Electric Manufacturing Co., Ltd., Stafford Works, Barford Street, Birmingham. June 3rd, 1920.

Hilstan, No. 404,024, Class 18.—Electric lighting sets for motor cycles, &c. Stanley G. Muir, 27, Melrose Gardens, Hammersmith, W. May 11th, 1920.

Apex, No. 401,508, Class 6.—Pumps, dynamos, dynamo brushes, and electromotors. W. J. Gooderidge, Colmore House, 21, Waterloo Street, Birmingham. August 5th, 1920.

Electrical Power Station Engineers' Salaries.—We have received from the Secretary of the Electrical Power Engineers' Association a copy of a letter, dated November 12th, regarding the conditions of employment and schedule of salaries for technical staffs in electricity undertakings, which has been sent to all electricity supply undertakings of 1,000 KW. and upwards in the United Kingdom, in which the National Executive Council points out that, as a result of the most unsatisfactory treatment which the members of the technical staffs have received at the hands of so many electricity undertakings, a serious situation has arisen which may have very disastrous consequences to the industry. The letter explains that on February 18th, 1919, an arbitration was held in London as a result of a claim made by the E.P.E.A. upon electricity undertakings throughout the kingdom for a war bonus for the technical staffs. The award, known as the No. 9,231 Award, conceding a bonus of 20 per cent., plus £90, was given on February 27th by Mr. W. H. Stoker, K.C., who acted as arbitrator. Embodied in the terms of the award was a recommendation that the bonus should be operative until a certain date, which was to be mutually agreed upon, and that in the meantime both parties were to meet and proceed to settle basic rates of remuneration for the various grades. In order to facilitate these negotiations, and in conformity with the advice given by the Ministry of Labour, it was decided to form a Whitley Council for the staffs in the electricity supply industry. This Council came into being on December 12th, 1919, with the title of the National Joint Board of Employers and Members of Staffs (Electricity Supply Industry), and was formally approved by the Ministry of Labour as being the competent body to deal with all questions affecting the members of the technical staffs in the electricity supply industry. It represents on the employers' side through their respective associations—such as the I.M.E.A.—all the various undertakings, both municipal and company—and on the employés' side the members of the staffs through their respective associations—such as the E.P.E.A. Immediately after its formation, the board appointed a committee to negotiate conditions of employment and schedule of salaries for the technical staffs. The negotiations were completed, and a schedule of salaries was approved in May, 1920, by the National Joint Board. This schedule was issued by the National Joint Board as an agreed claim on all statutory electricity undertakings of over 1,000 KW. capacity on May 21st, 1920, with the recommendation that it should be put into operation from June 1st. Several official communications on the matter have also been sent since that date to all the undertakings, both from the National Joint Board and from the constituent Associations represented on that Board; further, the constituent Associations have on several occasions urged their members to accept the findings of the Board.

It is now nearly six months since the schedule was submitted to the undertakings and a claim made for its adoption, but up to the present only a small proportion of such undertakings have adopted the conditions of employment and schedule of salaries. The members of the Association are extremely disappointed with the treatment meted out to them and the extent of their dissatisfaction is evidenced by the fact that 84 per cent. of the total membership of the Association has, by a ballot vote, empowered the N.E.C. to take whatever action it considers necessary to enforce the adoption of the schedule. The N.E.C. has considered the matter in all its aspects, and has decided that if the conditions of employment and schedule of salaries are not adopted in their entirety by all undertakings concerned by November 27th, 1920, they will be compelled to withdraw the services of the whole membership in the electricity undertakings covered by the schedule, on November 30th, 1920.

We have also received a letter signed by Alderman W. Walker, chairman of the National Joint Board of Employers and Members of Staffs (Electricity Supply Industry), and dated November 15th, and headed "Crisis in Electric Supply Industry." It refers to the foregoing letter, and states that at a meeting of the National Joint Board held at the Ministry of Labour on November 13th, the position was fully discussed, and at the special request of the employers' side, the Electrical Power Engineers' Association agreed to alter the dates given in the notice to December 11th and 14th respectively. The object of this postponement is to enable the employers' representatives to communicate with every electricity supply undertaking to avert the possibility of a national stoppage with all its consequences, by adopting the schedule which has been agreed by representatives of every section of the industry. We refer to this matter in our leading columns.

Book Notices.—"Cardiff as a Commercial and Industrial Centre" (273 pp.)—This illustrated handbook is divided into sections dealing with various phases of the city's business life, and it gives details of the municipal undertakings. A copy of the guide may be obtained post free from the Development Agent, City Hall, Cardiff, by any manufacturer or trader.

"*Punch's* Almanack" for 1921. Pp. xlvi + 28 and coloured supplement. London: Bradbury, Agnew & Co. Price 1s. net.—The incomparable art and humour of the venerable, yet sprightly, Mr. Punch remains at its constant high level. A ridiculously amusing story is contributed by Mr. A. A. Milne.

"Cheap Steam." Vol. IV. No. 6 (16 pp.). Published by Ed. Bennis & Co., Little Hulton, Bolton. Price 1s. post free.—The November issue contains an article on "The Comparative Reliability of Engines," by Edward Ingham, A.M.I.Mech.E.; "A Modern Colliery" (illustrated), &c.

New Belgian Company.—La Société Electro-Moteur is the name of a new company which has just been formed at Kiel, Antwerp (237, Chaussée Saint Bernard), with a capital of 1,200,000 fr., to manufacture dynamos, electric motors, electric lifts, &c.

Institute of Cost and Works Accountants.—The first of a series of lectures, arranged by the Institute, will be held on Wednesday, December 1st, at the Institute of Chartered Patent Agents, Staple Inn Buildings, Holborn, W.C., at 7 p.m. The lecture will be given by Mr. F. W. Pitt, on "The Influence of Production Costs on Designing." Admission is by ticket only, which may be obtained from the Secretary.

Wharf Cranes, &c.—The Department of Overseas Trade informs us that the Board of Harbour Commissioners, Vancouver, desires detailed information from United Kingdom manufacturers of mechanical equipment for loading and unloading vessels at the wharf side. Firms interested should write to Colonel G. H. Kirkpatrick, Chairman, Board of Harbour Commissioners, Vancouver, B.C., enclosing catalogues and full particulars as to prices, dates of delivery, &c.

Time Switches.—The Department of Overseas Trade has received an application from a firm in Winnipeg to be placed in touch with United Kingdom manufacturers of time switches for operating electrical signs. Quotations by cable, if possible, for the following quantities:—30 for 30 amperes, and 50 for 60 amperes, both at 250 volts. British firms may obtain the name and address of the firm from the Department.

For Sale.—Blackpool Corporation Electricity Department has for disposal the complete plant of the late Bispham Urban District Council Electricity Works, comprising three gas-producer plants, with three D.C. generators, switchboards, &c. For particulars, see our advertisement pages to-day.

German Industry.—German industry has recently received some very large orders from abroad. Speaking at a conference at Dresden, Herr Kraemer, head of the Saxon Coal Distribution Department, according to the *Daily Chronicle*, said that Russia and Poland alone had ordered many millions of marks' worth of goods, payment for which accompanied the placing of the order. Chemnitz firms had received orders from abroad to the extent of 77,000,000 marks (nominally £3,850,000). Wittgenadorf, near Chemnitz, was only prevented by lack of coal from completing orders valued at many million marks, which had recently been received from England. At Falkenstein Messrs. Siemens were planning the erection of a large factory equipped with the most modern machinery. Scarcity of coal, however, Herr Kraemer said, was proving a serious drawback in completing big orders. He had entered into direct negotiations with the coal miners of the nearest coalfield—dealings with the Berlin Government being worse than useless—and he was glad to say he had found them inclined to increase the output by working longer hours.

Swiss Electrical Industry.—The Swiss electrical industry appears to be very successful in maintaining its position in Spain. A Swiss concern has recently obtained an order from the Sociedad Productora de Fuerzas Motrices, a branch of the Energia Eléctrica de Cataluna, for two complete hydro-electric installations for the stations the company has under construction.—*Reuter's Trade Service* (Madrid).

Trade with China.—At a recent conference of British Chambers of Commerce in China and Hong-Kong, resolutions were passed recommending affiliation with the Association of Chambers of Commerce of Great Britain, and recording anxiety to co-operate to the fullest and most practical extent with the manufacturers of Great Britain in the advancement of the Empire's trade.

Mr. H. H. Fox, C.M.G., His Majesty's Commercial Counsellor from Shanghai, has now completed his tour of the industrial centres of the United Kingdom, and, pending his return to China in the first week of December, will be at the Department of Overseas Trade, London, at the service of any firms or individuals who may care to consult him on the subject of trade with China.

For Sale.—Llangollen and District Electric Light and Power Co., Ltd., invites offers for one 12 ft. × 6 ft. boiler, also one Howden's steam engine direct-coupled to a Crompton 220/240-volt dynamo. For particulars see our advertisement pages to-day.

LIGHTING AND POWER NOTES.

Australia.—Sydney.—Year's Working.—The report on the Sydney Municipal Electricity Department states that the total revenue for the year ended December, 1919, was £601,000, while working expenses amounted to £364,000. Of the gross balance of £237,000, capital charges, &c., absorbed £218,000, leaving a net profit of £18,900.

New South Wales.—Notification has been given by the Glen Innes Municipal Council of its intention to borrow a sum of £14,000 to provide for the town electric lighting scheme. The plant proposed will include three suction gas engines of 85 H.P. each and three 50-KW. generators.—*Tenders.*

Accrington.—Year's Working.—The total revenue for the year ended March 31st last, was £54,084, as against £43,097 for the previous year. The gross expenditure amounted to £43,369 (£33,422), leaving a gross profit of £10,715 (£9,675). The payment of capital charges resulted in a net loss of £989, which is an improvement on the deficit of £1,698 in 1918-19.

Batley.—Year's Working.—The abstract of accounts of the Corporation for the year ended March 31st last, issued last week, shows that there is a net loss on the electricity undertaking of £325 for the year, though there was a gross profit of £4,650. The loss is caused by interest on loans and sinking fund instalments. The loss, added to the deficiency at the end of the previous year, makes a total deficit to date of £4,176. For the past four years there has been a loss; the past year, however, showed an improvement on the previous year.

Buenos Aires.—Water Power.—A report prepared by the Minister of Public Works demonstrates the possibility of utilising the cataracts of Iguazu for the production of power. The cataracts would furnish 230,000 H.P., which would provide an average of 100,000 KW. for use in Buenos Aires. It is proposed to submit the project, which originated with the Minister Senor Pueyrredon, to adjudication, open to the whole world.—*Reuter's Trade Service* (Buenos Aires).

Clacton-on-Sea.—Loans Sanctioned.—The Urban District Council has received sanction to the loan of £9,670 for a new Diesel generating plant, and £858 in respect of excess expenditure on the present plant.

Continental.—Belgium.—The Compagnie d'Electricité de la Dendre, of Brussels, in its report for the year ending June 30th last, states that owing to delays in delivery of the material ordered, it has only been able to maintain a supply to its clients by means of small temporary generating stations. The first 2,000-KW. set at the permanent station has, however, now been started; the second is in course of installation, while the company has been able to purchase a 5,000-KW. set for immediate delivery so that by the end of the year the permanent plant will have a capacity of 9,000 KW. The company's distribution system comprises 47 miles of underground, and 66 miles of overhead cable working at 6,000 and 15,000 volts. The company is supplying energy to 25 small towns and villages, with a total of 7,950 customers; contracts have, however, been completed for the supply of electricity to 16 more districts which are all expected to be connected up during the course of the current financial year.

Russia.—Near Moscow are enormous deposits of peat waiting to be exploited. Already, before the war, an attempt was made to utilise this fuel on the spot, and in 1912 the first district electric power station, fired with peat, was erected to supply the needs of industry in the neighbourhood of Moscow.

Ekonomicheskaya Zhizn, of July 29th, is entirely devoted to the subject of an experimental electric power station which has been built near the Shatura bog, about 80 miles from Moscow, on the Lyubertsi-Arzamas Railway, and which began working on July 25th. For the present this station will serve as an auxiliary to the Moscow supply, and if the experiment proves successful a 40,000-KW. power station is to be built in the neighbourhood to provide for the needs of the districts around Moscow by means of a 115,000-volt transmission cable. The Shatura bog and that of Petrov-Kobelev had deposits sufficient to provide for an annual supply of electrical energy amounting to 100 million KW.-hours for about 100 years. An important item in the experiment is the use of marine boilers taken out of torpedo boats, for of such there are plenty ready to hand, but it is difficult to obtain new boilers from abroad, or to construct them in the country.—*Economic Review.*

Germany.—The Burgomaster of Berlin having addressed an ultimatum to the strikers at the electricity works, calling on them to resume work on penalty of dismissal, a ballot was taken on November 11th amongst the strikers which is stated to have given a majority in favour of resumption, and the Berlin City authorities announce that work has begun again in all the establishments involved.—*Reuter's Trade Service* (Berlin).

Huddersfield.—New Turbo-Generator.—The new 6,000-KW. turbo-generator set was recently put into commission. It is a 6,600-volt, three-phase set, running at 3,000 R.P.M., made by the English Electric Co., Ltd. The condensing plant, supplied by Messrs. Mirrlees, Watson & Co., Ltd., is capable of dealing with half a million gallons per hour. The new boilers have an output of 45,000 lb. of steam per hour.

Liverpool.—New Station.—It is hoped to complete, by the end of the year, the new installations at Lister Drive power station. These installations are, it is claimed, far ahead of those in use at any other electrical power station in the country. Mr. F. C. Wilson, who, as chairman of the Tramways Committee, is particularly interested in the municipal electrical supply, has come back from a visit to the United States in the belief that there, too, they have nothing better in this line, although their power stations in some cases are very much larger.—*Liverpool Daily Post and Mercury.*

London.—The electric light in the House of Lords failed on Monday, owing, it is thought, to fusing of the wires, which could not be traced. The Law Lords adjourned for a long luncheon interval in order that temporary lighting arrangements might be made.

Stoke Newington.—Mr. C. H. Wordingham, C.B.E., has submitted a report upon the proposed extension of plant and mains at the electricity works. The first stage recommended is the installation of a 500-KW. rotary converter and switchgear, as well as mains extensions, at an estimated cost of £30,000. The scrapping of the existing storage battery and the substitution of a night shift is advised.

Stepney.—The accounts of the Corporation electricity undertaking for the year ended March 31st, 1920, show a total revenue of £205,156, as compared with £175,835 for the previous period. Working expenses amounted to £139,421, against £110,154, leaving a gross profit of £65,735 (£65,681). After payment of capital charges the result was a net profit of £23,376 (£22,245). The number of units generated rose from 28,811,770 to 30,836,840.

Mosley Common.—Fire.—About 400 miners were unable to go to work on the 15th inst. at the Mosley Common pit on account of the central power station having been burnt down.

Nelson.—Extensions.—The Council is committed to heavy expenditure on such schemes as additions to electrical plant, &c., the estimated cost being £750,000.

New Zealand.—Water Power.—The Southland Electric Power Board is energetically pushing forward its hydro-electric works. The preliminary work connected with the system is proceeding at first for a plant giving 8,000 H.P., with a distribution over 1,700 miles, and a reticulation of 3,000 sq. miles. The greater part of the third pipe line for the Lake Coleridge station has arrived in Auckland; it is ½ mile in length, with a diameter of 52 in., and is from ¼ to ½-in. thick. It is made of British steel plate, rolled, drilled, and curved before shipment; it will be riveted on the site. The additional machinery for the Lake Coleridge plant is already on site, and will be used as soon as the new pipe line is ready. It will provide 4,000 H.P., equivalent to 3,000 KW., which will increase the capacity of the Lake Coleridge station to 12,000 H.P., but the new equipment will do little more than ease the present overload, and serve as a standby. Tenders have been accepted for the final unit of 4,000 H.P. to complete the original 16,000 H.P. for which the station was designed. Tenders are yet to be called for the fourth pipe line.—*Reuter's Trade Service* (Melbourne).

Nottingham.—New Power Station.—No time is being lost in preliminary arrangements for the erection of the new super-station, the Corporation's scheme having now received the sanction of the Electricity Commissioners to the exclusion of the Notts. and Derbyshire Co.'s application for authority to exercise powers of supply within the municipal area. The approximate cost of the first stage of the project is £850,000, the total estimated expenditure being set down at £1,250,000. Preparation of the detailed plans is now being effected by Mr. J. H. Rider, the Corporation's electrical expert.

Peterborough.—Loan Sanctioned.—The Town Council has received sanction to borrow £52,890 for electricity extension purposes.

Plymouth.—Financial Returns.—A return by the borough treasurer shows that during the past 21 years there has been a net profit of £40,671 on the electricity undertaking, the net value of which is £220,931.

South Africa.—Power from Waste Gases.—The Dundee Coal Co. proposes, in connection with its Waschbank by-product plant, to utilise waste gases in the generation of electricity for transmission to the Burnside colliery—a distance of 10 miles.

Bloemfontein Extensions.—At a meeting of Bloemfontein ratepayers, the Town Council was authorised to raise a loan of £50,000 for the purpose of extending the electric power system. Experts had recommended the erection of a new power station at an estimated cost of £150,000, but, in view of the present state of the financial market, it was not thought advisable to proceed with the big scheme immediately, and two stop-gap schemes were put forward. The first of these was calculated to cost £15,500, of which £10,000 would be lost in moving to a new station at the expiration of three years. The second scheme, which the Town Council recommended for the approval of the ratepayers, was estimated at a cost of £30,000, to last for five years, at the end of which £18,000 would be lost on moving to the new station. It was also estimated that after five years of working, the second scheme would show a loss of £5,000 less than the first scheme and would also provide more reserve power for use when necessary.—*S.A. Mining and Engineering Journal.*

Walsall.—Loan.—Application is to be made to the Electricity Commissioners for sanction to borrow a sum not exceeding £32,000 for four E.H.T. feeders (£20,000) and switchgear (£12,000) required to meet the anticipated demand for electricity during the ensuing three years.

The Electricity Committee is to raise no objection to the inclusion of Walsall in the proposed new North-West Midlands Electricity District, and is to renew the representations made two years ago in favour of the linking-up of generating stations in South Staffordshire.

The Electricity Commissioners having consented to the completion of the Birchills generating station, the Committee has authorised the obtaining of tenders for the remainder of the plant required.

Electric Police Lamps.—The Watch Committee recommends that 50 electric police service lamps be purchased, at a cost not exceeding £55.

Whitehaven.—Loans.—The Town Council has applied for loans of £2,500 for new condensing plant, and £4,000 for meters for four years.

York.—Electricians' Wages.—A conference on the working conditions and rates of pay obtaining in the electrical trades has been concluded. The terms offered by the employers were :—Time and a-third for night shift, time and a-half for overtime up to midnight, with double time after, and an out-of-town allowance of 4s. 3d. per day. Representatives were present of the National Federated Electrical Association and the Electrical Trades Union, but the Electrical Contractors' Association of Scotland was not represented. An agreement was reached with regard to educational facilities for apprentices, but the settlement of the rates of pay for apprentices was deferred. The men's representatives declared themselves unable to confidently recommend the night shift and out-of-town allowances, but ultimately agreed to submit the proposals for branch consideration.

TRAMWAY AND RAILWAY NOTES.

Bradford.—Year's Working.—The annual report on the Corporation tramways, for the year ended March 31st last, shows that the total receipts were £608,991, as against £494,246 in the previous period. The total of working expenses was £501,534, compared with £375,074, leaving a gross balance of £107,457 (£119,172). The payment of capital charges left a net profit of £44,838. Last year's profit was £60,826.

Brazil. — Railway Electrification. — The Senate Finance Committee has reported favourably on the question of a credit of 60,000 contos for the electrification of the Brazilian Central Railway.—*Reuter's Trade Service* (Rio de Janeiro).

Continental. — Spain. — According to "A.B.C.," the Norte Co. has a project for the electrification of the railway line from Barcelona to Tarrasa. The work will be put in hand at the beginning of next year, and will be terminated, it is hoped, in 1923. Further plans under consideration relate to the electrification of the line as far as Saragossa.—*Reuter's Trade Service* (Madrid).

Lancashire.—Wages During Strike.—The curtailment of tramway services during the miners' coal strike has led to several disputes with the tramway employés in Lancashire. The employés of the Ashton Corporation and the Stalybridge Joint Board struck work on Saturday, on the refusal of the authorities to grant the men's demand, presented on 24 hours' notice, that they should be paid for short time during the miners' strike. Some 400 men are "out," and the dispute affects the whole of Ashton, Stalybridge, Dukinfield, Mossley, and Hyde, with a population of a quarter of a million. A similar dispute at Burnley was averted at the eleventh hour by the men accepting the Corporation's terms. They demanded a full week's pay from the day the miners' ballot settled the coal trouble, but have accepted the Corporation's terms, which meant a loss of only six hours. Manchester avoided any drastic action by conceding the employés' demands.

London. — Electric Vehicles. — The Shoreditch Highways Committee recommends the Council to authorise the purchase of two Orwell electric dust collecting vehicles at a cost of £1,750 each.

Projected Tube Railway.—Mr. H. J. Buckland, general manager of the Crystal Palace, in acknowledging a presentation made by the chief exhibitors in the Oil Section of the recent Victory Exhibition, mentioned that the exhibition was visited by 1,175,564 persons. The Crystal Palace was now Government property, run as a semi-Government undertaking, without any funds or any subsidy. But the exhibition had been so successful that they had now got some funds, and he looked forward to the future of the Palace with optimism, especially in view of the projected tube railway to Sydenham Hill. The tube would run from Finsbury Park, through the Strand, to Dulwich and the Palace. The Bill would probably receive the Royal Assent next May or June, and the cost of the undertaking would be about £11,000,000, of which £7,000,000 was already assured. The other £4,000,000 would be offered to the public.—*The Times.*

Breakdown.—Owing to a breakdown at a power station, the Metropolitan Electric Tramways were held up for about 15 minutes in the Highgate district early on Monday.

Potteries.—Strike.—The tramway employés struck work on November 8th, and no tramway cars or omnibuses have run in the district since the Sunday night. The dispute arose out of the restricted service in operation during the coal strike. When the agreement guaranteeing a 48-hours week or equivalent pay was suspended on November 6th, the Stoke-on-Trent branch of the United Vehicle Workers' Association demanded its reinstatement. The Potteries Electric Traction Co. stated that if it complied, it must suspend some of the men more recently engaged until traffic again became normal. The Union refused to agree, and, without consulting the parent association, called a strike on the morning of November 8th. A prolonged conference between the Potteries Electric Traction Co. and representatives of the men, at which Mr. F. S. Jackson (of the Ministry of Labour) was present, ended in a deadlock. The men resumed work on November 13th. The Potteries Electric Traction Co. has consented to the reinstatement of the agreement guaranteeing a 48-hours week or equivalent pay, and agreed that there should be no reductions in the staff without consultation with the union representatives.—*Daily Telegraph.*

Stretford.—Loan.—Application is to be made to the Ministry of Health for loans amounting to £64,000 for tramway extensions. This provides for the doubling of the single line, and a new double line along Seymour Grove, with a connecting line along Talbot Road. The new lines will extend about a mile.

Sunderland.—Increased Fares.—It has been decided to take the following steps :—To increase the fare from 2d. to 3d. on special cars between the Town Hall and Roker Park Football Ground ; to extend the service from 10.30 to 10.45 p.m. on weekdays ; to double the present single line of tramway between Side Cliff Road and Browne Road, in Fulwell Road, at a cost of £1,267 ; and to make an additional entrance to the Wheat Sheaf depôt by laying a double line *via* Dundas Street, at an approximate cost of £2,550.

Wages.—For the past six months the undertaking has been run at a loss of £939, the total revenue being £83,000. The traffic employés have asked for an advance of 12s. per week in wages, which, if granted, will mean a further expenditure of £12,000 a year.

Wage Demands.—Increased Fares.—In the report of the National Joint Industrial Council for the Tramway Industry issued on the 13th inst., in connection with the demand of 47,273 employés of 81 municipal authorities for an increase of wages, as from October 15th, of 12s. per week for adults, and 6s. for youths under 18 years of age, the conclusion come to is that if the tramway industry is to be saved from financial disaster, fares must inevitably be increased. The application was first heard three weeks ago, when the company representatives retired, declaring their inability to concede an advance. The municipal authorities proposed an adjournment to permit of an inquiry (resulting in the above report) on the relation of increased wages and bonuses to the increased costs of living, and the effect of increased fares on the financial conditions of the undertakings. As a whole the industry was carried on at a dead loss of at least £1,555,859 during the last financial year, and the present demand of the employés would involve a further charge of, approximately, £1,481,100 per annum.

On October 1st when the cost of living had increased by 164 per cent. over the 1914 figures, the percentage increases in wages were :—Drivers, 132 ; conductors, 147 ; car repairers, 140 ; and car cleaners, 163. Mr. J. Cliff, joint secretary for the Trade Unions, says that with the reduction of working hours from 60 to 48 the increase in the hourly rate of wages has not increased the number of shillings earned. In fact, outside the London area, it has meant a reduction in weekly wage. On the side of the municipalities, Mr. Beckett says that in spite of the 20 per cent. reduction in work, the wages in many cases have gone up by 25 per cent. on both basic and bonus rates. While 47 undertakings earned not more than 11d. per car-mile in 1913-14, 61 earned not less than 18d. in 1919-20. In September and October this year no undertaking earned less than 15½d. a mile, and only 17 out of the 81 earned less than 20d. The present application for increased wages, if granted, would cost an extra £1,481,100, or 1·59d. per car-mile ; and as the annual loss now amounts to £3,310,753, the loss in 1920-21 on 223,825,536 car-miles would be £4,793,597. This is a serious problem if the tramway industry is to be saved from financial disaster. At present the actual revenue of the whole industry falls short of expenditure by 3·55d. for every car-mile. With the extra wages it would be 5·14d., or 4s. 8d. loss on every £1 of traffic receipts. "This," says the report, "is a condition under which no industry can survive." Twenty-five out of 98 local authorities owning tramways have applied for orders to increase fares.

An official statement has also been issued by the Conference of Tramway and Light Railway Companies, all of which declined to take part in the investigation, which puts the case for the company undertakings and shows that tramway companies are in an even more difficult position than the municipal undertakings, as they are unable to call upon the rates to make up their trading losses. So much time has been occupied by the Ministry of Transport in considering data put before it, that even to-day many companies have not yet received permission to bring any increase of fares into force ; but ever since March the increased wages have been paid. Taking the tramway industry as a whole, the financial position is worse to-day than it was when the Tramways (Temporary Increases of Charges) Act, 1920, was passed, relaxing the statutory restriction of fares to enable higher wages to be paid. The present demand is being pressed at a time when the companies have not been able to adjust their revenues to the scale of wages which was put in operation last March. Even when that adjustment is completed, it will take a long period to make good the excess of expenses which has accumulated since that date. Further, there are signs that the economic limit of fares is being approached, if it has not already been reached in many cases, and some relief from the onerous legislative conditions, in any case, is imperatively required. The time has come when it has to be decided whether tramway undertakings shall be carried on as commercial enterprises and be self-supporting, or whether they shall depend upon subsidies from one source or another. Municipal undertakings are in a position to meet the situation by a subsidy from the rates. Company undertakings have no such remedy, so they are unable to negotiate any further increase in wages which the exhaustive inquiry made last March showed to be financially impossible. Whereas an employé earned, on an average, 6d. per hour in 1914, he is now earning about 1s. 6d. an hour, without overtime. This is a greater percentage advance than the percentage increase in the cost of living as shown by the "index figure" published by the Ministry of Labour. A tramway company spends to-day on labour something like £300 per annum for every £100 per annum spent in 1914.

TELEGRAPH AND TELEPHONE NOTES.

Anglo-German Cable Communication.—It is semi-officially stated in Berlin that hitherto only three of the six telegraph cables between Emden and the English coast which were damaged during the war have been reopened to traffic, but a fourth cable has now been put in order by British and German ships. Repairs on the other two cables will take some time to complete. It is expected that telegraphic communication with England will be substantially improved by the restoration of the fourth cable.—*Reuter's Trade Service* (Berlin).

The Conference on international communications now sitting at Washington, U.S.A., is approaching the end of its labours. According to the *Daily Telegraph*, the main point in the American contention concerning France and Britain was that the two cables formerly joining up America and Germany which had been landed by the British at Penzance and Halifax, and by the French at Brest, shall be re-established in their former positions, and be used again in order to secure direct communication between the States and Germany. The British Government has just decided to give way to the American pressure, provided the ownership of the cable continues to be British. It is very likely that France will have to adopt a similar attitude for the Brest-New York cable.

Australia.—Telephone Extensions.—A sum of £380,460 is to be expended in 1920-21 on the improvement of the telephone and telegraph services in New South Wales, allotted as follows: Telegraphs, £9,460; telephones, £117,000; new trunk lines, £30,000; switchboards, £39,000; cable and conduits, £183,000; and miscellaneous, £2,000. In addition, tenders for further materials are to be accepted and paid for this year, and other tenders are to be invited and paid for in 1921-22 up to a total of £500,000. This year £43,000 has already been expended by commitments; the estimated cost of providing additional switchboards at the new automatic exchange in Sydney is £81,784, and £3,750 has been provided for increasing the country service, which will enable 15 lines to be erected; 25 others have been approved, and material is to be obtained. All essential materials can be procured if funds are provided, but deliveries are subject to delay.

The increase of 3d. on general telegraph rates and a proportionate increase on Press message rates is expected to bring in a revenue of £184,000. The 25 per cent. increase, with exemptions for country districts, on telephone rates is expected to result in £275,000 extra revenue.

Wireless Telephony.—The use of wireless telephony for communication with remote districts is being experimented with by the Postal Department. If the experiments justify it, the P.M.G. hopes in the near future to establish a wireless-telephone service for residents in remote places where land line communication would be prohibitively costly. He points out, however, that the use of wireless telegraphy, which is developed to a greater degree than wireless telephony, for commercial purposes, offers more satisfactory conditions as regards skilled attendance, cost, and facility of operation, and he has already approved of licences being granted for the erection of such stations in the Northern Territory and remote parts of Queensland and South Australia. They will be in communication with existing Commonwealth radio stations.

British Cables.—The British Isles were entirely cut off from the rest of the world during the two minutes' silence on the morning of November 11th, all telegraph cables being released from traffic.

Dutch East Indies.—New Cable.—The Dutch Government has placed an order with the Norddeutsche See Kabelwerke for from 1,500 to 2,000 sea miles of cable, destined to establish telegraphic communication among the islands of the Dutch East Indies. The important contract will keep the above-mentioned works busy for a considerable time. The gutta percha used in the manufacture of the cables comes principally from the Dutch colonies. The two cable ships formerly used by Germany have, by the terms of the Peace Treaty, been delivered to the Allies. One is in the possession of England and the other of Italy. They will be definitely disposed of at the International Communications Conference at present being held at Washington. In the circumstances the cables will be laid by a large German freight boat, converted for the purpose into a cable ship, and which will proceed to the Dutch East Indies at the beginning of next year.—*Financier.*

France.—New Wireless Station.—The French wireless station of Croix d'Hins, whose construction was begun in 1917 for the use of the American Expeditionary Force, has just made its first transmission trials. This post is 23 km. south of Bordeaux, and consists of an antenna of 20, 40/10-wires, 1,500 metres long, covering an area of nearly 70 hectares. The antenna is supported on eight metal standards, forming a triangular pyramid, having 60 metre sides at its foot and being 250 metres high, spaced 400 metres apart. The generators have a power of 1,000 kw., feeding an arc and a high-frequency alternator. The length of the wave is 20,000 metres,

Sweden.—Telephone Charges.—The increased telephone fees recently imposed have aroused indignation all over the country. According to the *Financier*, before the State Telegraph Department bought the Allmanna Telefonbolaget, its only competitor, it tried to keep the fees low, but no sooner had it bought the company than its policy was changed.

Switzerland.—League of Nations' Wireless Station.—The Geneva wireless station, by means of which journalists attending the Conference of the League of Nations are securing a rapid distribution of their messages, is situated on the Bel Air plateau at Chene Bourg, about three miles south of the city, and at an elevation of about 1,400 ft. The station embodies all the latest developments in commercial wireless, including a Marconi valve transmitter operated automatically at high speed, but the outstanding feature in this instance is the speed with which the station has been erected. In the case of the Geneva station a normal three months' job has been completed in a fortnight, including the erection of a lattice steel tower 200 ft. high and weighing many tons. The first wireless gear, owing to delays on the railways, did not reach Geneva until November 4th, yet on November 9th the station commenced its trials. Three special buildings have been constructed on the site. In the first is the power plant, where current obtained from the Geneva electric service drives a motor, which in turn rotates a specially designed generator. As a precaution against any interruption by the failure of the external supply the plant is duplicated, the second motor being driven by an Austin petrol engine. In the second building are housed the 6-kw. valve transmitter, the Creed high-speed signalling devices, and all the usual wireless auxiliaries, whilst in the third building, nearest the aerial tower, are the instruments for the translation of the messages into tape form, which tape is fed at high speed through a Wheatstone automatic transmitter. This building is in direct telegraphic and telephonic communication with an office in Geneva adjoining the Conference Hall, and also with a station five miles distant, where the acknowledgements from various European stations are received. The transmitting aerial is of the umbrella type, the wires being radiated from the central tower to the tops of the numerous masts ranged around the tower at a distance. The earth system is located beneath the aerials. Motor cyclist dispatch riders are being employed to supplement the telegraphic communication between Geneva and the wireless station. Direct wireless communication is being provided by this station between Geneva and a specially-erected receiving station at Witham, Essex, which is connected by telegraph to the Marconi Co.'s London offices. The transmitting station in this country is at Chelmsford, and is in direct telegraphic communication with Witham. Wireless services from Geneva to Nauen (Germany), Amsterdam, Budapest, and Lyngby (Denmark), have been arranged, and it is hoped to extend the scheme to Norway, Spain, Italy, and other European countries. The local authorities at Geneva have been unsparing in the support and assistance they have extended to the Marconi officials entrusted with the work of constructing the station, and on November 14th the President of the Swiss Republic visited the Geneva station.

Wireless Telegraphy.—Direction Finding Stations.—Instructions are given in a "Notice to Airmen" recently issued by the Air Ministry, with regard to the employment by aircraft of the wireless direction-finding stations established at nine points along the British coasts by the Royal Navy. Such means of identifying locality should prove very useful to aircraft.

Fixing Longitude.—It is proposed to utilise wireless telegraphy in determining the exact position of the boundary between South and West Australia. The boundary is fixed by Act of Parliament as the 129th degree of longitude east of Greenwich. The exact position of the longitude will be ascertained by the use of time-signals from a high-power wireless station situated at some point between the Greenwich Observatory, in England, and Sydney, in Australia, the signals being received simultaneously at both stations. Most of the great observatories of the world are now collaborating in a redetermination of the longitudinal division of the earth's surface by means of wireless time-signals. Given favourable static conditions, it has been found that signals from the Lyons wireless station, in France, can be received in Australia as well as at Greenwich, and signals from other stations more favourably situated are also being tested. The co-operation of the United States as well as the British Government has been invited. The scheme is the first step towards a comprehensive redetermination of the whole longitudinal survey of Australia.—*The Times.*

Wireless Telephony.—Mr. Godfrey Isaacs, managing director of the Marconi Co., sailed on the 13th inst. for the U.S.A., where he hopes to complete plans for the creation of a trans-Atlantic wireless telephone service between New York and London, Paris, and other European centres. He is said to believe that such communication can be established at a cost only slightly greater than that of cablegrams, and that a marked saving of time will be made.

A wireless telephone set, operated with current from the batteries of a motor car and transmitting and receiving over an aerial wire stretched from the top of the wind screen to the radiator cap, is the latest equipment provided for the modern motor car or truck, says the *Daily Despatch.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—January 19th, 1921. Victorian Railways Department. Electric furnace and equipment, &c. Particulars from the Agent-General for Victoria, London, S.W.—*Tenders.*

Western Australia.—December 28th. Postmaster-General's Department. Telegraph and telephone instruments and parts. (Schedule 689).

Tasmania.—December 13th. P.M.G.'s Department. Instrument parts, schedule T 301. (November 12th.)

Queensland.—P.M.G.'s Department. Testing and telegraph instruments (schedule 517). (November 12th.)

Belgium. — December 14th and January 25th. The municipal authorities of Antwerp, Electric motor and pump, for the raising of the bridge over the Royers Dock. 20 5-ton electrically-operated cranes. Specifications can be obtained from the Hotel de Ville, Antwerp.

Canterbury.—December 6th. Electricity Department. E.H. pressure and medium pressure D.C. switchgear and cable connections to the same. (See this issue.)

France. — November 26th. French State Railway authorities. Two electrically-operated travelling cranes at the La Garenne electrical repair shops. Particulars from the Service Electrique, 88, Rue de Rome, Paris.

Grimsby. — November 29th. Electricity Department. Sub-station converting plant, traction converting plant, comprising one 250-kw. and one 500-kw. converter, and one 250/300-kw. converter. (November 12th.)

Leeds. — December 13th. Electricity Department. Three-phase switchgear for the generating station. (November 12th.)

Liverpool.—November 26th. Cheshire Lines Railway Committee. Stores during 1921, including (6) telegraph materials and carbons. Stores Superintendent, Warrington.

London.—November 24th. Metropolitan Asylums Board. Alterations and extensions to the electric lighting and power installations in the motor workshops at the head ambulance station, Carnwath Road, Fulham; hot water supply apparatus at the Eastern Hospital, Homerton; continuous drying machine at Leavesden Mental Hospital. (November 12th.)

November 22nd. Great Western Railway. Three or six months' supply of stores, including telegraph instruments and apparatus, electrical wires and cables, &c. (See this issue.)

Monte Video. — January 14th. Management of the Usinas Electricas de Monte Video. Steam turbo-alternator of 10,000 kw. with the steam piping and cables; surface condenser with pumps, &c. Copy of conditions and specification (in Spanish) may be seen at the Department of Overseas Trade (Mr. Holloway) up to December 4th, after which date it may be borrowed by British firms.

New Zealand.—January 17th. Napier Municipal Council. Supply of one 500-kw. gas-electric generating set.—*Reuter's Trade Service* (Wellington).

Plymouth.—November 30th. Electricity Department. H.T. and E.H.T. switchgear; oil-cooled transformers. (November 12th.)

Rhodesia. — Salisbury. — January 13th. Municipal Council. Electric generating plant, switchgear, cable and converters. Specification (£3 3s.) from the Council's Consulting Engineer, Royal Chambers, Johannesburg.

Whitehaven.—December 1st. Electric Supply Department. One D.C. turbo-alternator and condensing plant. (See this issue.)

York.—November 25th. North-Eastern Railway Co. Six or 12 months' supply telegraph apparatus, telegraph wire, and line stores. (See this issue.)

CLOSED.

Australia.—P.M.G.'s Department. Queensland:—

10 tons 12 cwt. H.D. copper wire (200 lb. per mile), £1,742.—Metal Manufacturers, Ltd.

P.M.G.'s Department. S. Australia:—

20 selectors and 10 P.B.X. connectors for the Port Adelaide Exchange, £800.—Siemens Bros. & Co., Ltd.

P.M.G.'s Department. West Australia:—

4 tons 11 cwt. H.D. copper wire (200 lb. per mile), £792.—British Insulated and Helsby Cables, Ltd.

Selectors, repeaters, and associated equipment for Perth Main Exchange, £664.—Automatic Telephones (Australia), Ltd.

Sydney.—N.S. Wales Railway Commissioners. Accepted:—

18,750-kw. turbo-generator, for the White Bay power house.—English Electric Co. (Australia), Ltd.

Tenders.

Aberdeen.—Rewiring work in connection with the reconditioning of Oldwill Hospital, £399—A. B. Robertson and Son, Ltd.

Belgium.—Fourteen firms submitted tenders last week to the municipal authorities of Schaerbeek, near Brussels, for the supply of 1,675 single-phase and three-phase electricity meters. The lowest offer was that of M. E. Lejour, of Couillet, the Metropolitan-Vickers Co. being second. A Belgian firm submitted a tender on behalf of a German manufacturer, but this was not considered.

Sunderland.—The Town Council has accepted:—

Ferranti, Ltd., 72 meters.
Ferguson, Pailin & Co., Ltd., H.T. switchgear.

FORTHCOMING EVENTS.

Edinburgh Electrical Society.—Friday, November 19th. At the Philosophical Institute. At 8 p.m. Paper on "Medical Electricity," by Dr. W. Hope Fowler.

Institution of Mechanical Engineers.—Friday, November 19th. At the Institution, Storey's Gate, S.W. Paper on "Sterilisation of Water by Chlorine Gas," by Capt. J. S. Arthur.

Junior Institution of Engineers.—Friday, November 19th. At 39, Victoria Street, S.W. At 7 p.m. Annual general meeting. Discussion on "Economical Transmission of Power," to be opened by Mr. G. H. Ayres.

Institute of Marine Engineers.—Tuesday, November 23rd. At the Institute, Minories, E. At 6.30 p.m. Paper on "Some Suggestions on the Training of Engineers," by Mr. J. A. S. Hall.

Institution of Electrical Engineers.—Thursday, November 25th. At the Institution of Civil Engineers. At 6 p.m. Papers on "The Distribution of Electricity," by Mr. W. B. Woodhouse, and on "Some Economic Aspects of E.H.T. Distribution by Underground Cables," by Mr. R. O. Kapp.

(Students' Section).—Friday, November 19th. At the City and Guilds (Engineering) College, South Kensington, S.W. At 6.30 p.m. Opening address by Mr. C. C. Paterson on "The Incandescent Electric Lamp from the Inside."

Friday, November 23th. At the City and Guilds Technical College, Leonard Street, Finsbury. At 6.30 p.m. Paper on "Electricity and the Paper-making Industry," by Mr. A. J. C. Watts.

(North-Midland Centre.)—Monday, November 22nd. Joint meeting with the Sheffield Society of Engineers and Metallurgists. At the Marpin Hall, Sheffield. At 7.30 p.m. Paper on "Permanent Magnets," by Prof. E. H. Capper.

North-Eastern Centre.—Monday, November 22nd. At the Armstrong College, Newcastle-upon-Tyne. At 7 p.m. Statement by the local chairman on the proposed increase in the Institution subscription, followed by Mr. W. B. Woodhouse's paper on "The Distribution of Electricity."

(North-Western Centre).—Tuesday, November 23rd. At the Engineers' Club, Manchester. At 7 p.m. Papers on "The Distribution of Electricity," by Mr. W. B. Woodhouse, and on "Some Economic Aspects of E.H.T. Distribution by Underground Cables," by Mr. R. O. Kapp.

Wireless Sectional Meeting.—Wednesday, November 24th. At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. Address by Dr. W. H. Eccles, Chairman of the Wireless Section.

Physical and Optical Societies.—Friday, November 26th. At the Imperial College of Science and Technology, South Kensington, S.W. At 7 p.m. Joint discussion on "The Making of Reflecting Surfaces."

Manchester Association of Engineers.—Saturday, November 27th. At the Memorial Hall, Albert Square. At 7 p.m. Paper on "Modern Developments in the Manufacture and Utilisation of Coal Gas," by Mr. F. J. West and Mr. J. A. Tomlinson.

NOTES.

Wireless Operators, &c.—A bounty of £100 will be paid to a certain number of trained wireless operators, electricians, fitters, and instrument repairers who are finally approved for the Royal Corps of Signals on passing the necessary trade test. For particulars see our advertisement pages to-day.

Miners' National Wages Board.—The first meeting of the Miners' Executive Committee with the Coal Owners' Association took place on the 12th inst., when business of a formal and preparatory character was transacted. Sub-committees were formed to deal with various matters, including ways and means of increasing output and the setting up of the proposed National Wages Board.

Electricians' Strike.—Electricians, fitters, and labourers employed at Garston Docks, near Liverpool, are on strike owing to a wages dispute. As a result, night work at the docks has been seriously interfered with owing to the absence of illumination. For two months past electricians and joiners at Liverpool have been haggling over whose right it is to erect electric lift guides.

It is stated that, following the strike of the E.T.U. at Belfast, a number of the electricians have resigned, or will resign and join another Trade Union. Some of the strikers returned to work last week. The shipyards, factories, and other public works in Belfast were practically unaffected by the strike, the main issue being connected with contractors' firms.

Electric Road Rollers.—The suggestion of Mr. A. Blake, electrical engineer to the Willesden Borough Council, that electric propulsion might be applied to road rollers is, we understand, receiving attention. In dealing with the subject, *Electricity* remarks: "The fundamental principle of all rollers, viz., weight over the axis of the rollers, would be materially assisted by the use of a heavy battery."

Diesel Engine Users' Association.—A summary has been prepared of information and recommendations with regard to the life of connecting-rod bolts of Diesel and semi-Diesel engines, and their treatment. The subject has been discussed at several meetings of the Association, and the principal points elicited in the course of the discussions should be useful, not only to members of the Association, but to other engineers who are concerned with the care of reciprocating engines.

Theft of Cable and Fittings.—In Clydebank Police Court, on November 1st, A. Cairns (46), electrician's mate, was sentenced to 30 days' imprisonment for stealing a quantity of electrical fittings, cable, wire, brass fittings, &c., from the electrical department of the Dalmuir Naval Construction Works.

The Industrial Court.—The Electrical Trades Union and Colchester Corporation.—As we go to press we learn that the Industrial Court has decided that the schedule of wages fixed by the District Council No. 9 of the Joint Industrial Council for the Electricity Supply Industry shall be paid by the Corporation to the respective grades of workpeople concerned, as regards half the advance from May 1st, 1920, and as regards the remaining half from January 1st, 1921. The claim of the Electrical Trades Union is therefore upheld by the Court.

Russian Trade.—The Cabinet was to again discuss the proposed Russian Trade Agreement this week. Although some members of the Cabinet favour the resumption of trade with Soviet Russia, others are against the proposal on the ground that further guarantees are necessary with regard to Russian national debts. It is reported that a suit will be instituted by a firm of London solicitors, on the conclusion of the trading treaty with Soviet Russia, on behalf of more than 1,200 British firms and private individuals, against the Soviet Government for the amount of money lost through the confiscation of their property and securities in Russia. "Our suit will be lodged on the grounds that the conclusion of the trading treaty will constitute a diplomatic recognition of the Soviet Administration as a *de facto* Government," the head of the firm which will conduct the suit told a *Daily Mail* reporter. "An injunction will also be brought against M. Krassin to prevent him from disposing of the Bolshevist gold until our case is tried." The amount of money involved runs into many millions of pounds.

Housing and Electric Transport. — Discussing the subject of "Railways and Real Property: A Glance into the Future," at a meeting of the Auctioneers' and Estate Agents' Institute, Mr. F. R. E. Davis (of the Great Western Railway) said that lack of transport facilities in the past had unquestionably contributed to the overcrowding which existed in most large towns and other busy centres of industrial activity. The remedy was to be found in the establishment of a frequent, rapid, and reasonably cheap train service, to enable the workers to reside in more healthy surroundings, and yet reach their places of employment without the necessity of having to spend an unduly long time in travelling. The need could largely be met by the introduction of fast suburban electric train services. A satisfactory solution of the means of providing easy access to suitable housing sites some distance from town areas not only put the advantage of rural life within the reach of the worker, but also enabled a substantial saving to be effected in the initial cost of the schemes, since the price for building land should be considerably cheaper in outlying districts than in towns. The necessity, in preparing a town-planning scheme, for co-operating from the initial stages with the authority responsible for providing the railway facilities was obvious.

Mr. Frank W. Hunt, chief valuer to the London County Council, said that probably one of the most important and difficult subjects with which every public authority had to struggle to-day was the provision and the improvement of means of transport. They saw the difficulty, of course, in the most exaggerated form in London. As Mr. Davis rightly said, the capacity of the existing lines could be enormously increased by conversion to electric traction.

Science and Research.—At the annual meeting of the National Union of Scientific Workers, held on Saturday last, Prof. Soddy moved a resolution, which was unanimously adopted, disapproving of the policy of the Department of Scientific and Industrial Research, which handed over to the private use of profit-seeking monopolies valuable knowledge obtained at the expense of the whole community, and placed the research associations in a position to exploit the scientific workers of the country for their own benefit.

Prof. Soddy said it had been laid down explicitly in the White Paper No. 8,005 (1915) that discoveries aided by public money should be made available, under proper conditions, for the public advantage. At present the public had no share in the results of what they paid for, and the researcher lost his property in his own discoveries. The Government had capitulated to the big business interests in politics and departed altogether from its original intentions.

In his presidential address, Dr. J. W. Evans said he regretted that the scientific and technical faculties of universities played only a subordinate part in the scheme the department had adopted for the promotion of research. In his view, a teaching staff engaged in research work was in a more favourable position to discover and develop new principles, applications, and methods than in the laboratories of research associations, or even Government institutions established for scientific investigations.—*The Times.*

The Workers' Direct Interest in Output.—Mr. Stanley Machin, president of the London Chamber of Commerce, discussing labour troubles and the remedy, at a gathering of the Castle Baynard Ward Club, said poisonous doctrines could be removed by personal contact with the workers, the development of welfare work, and the encouragement of the truth that workers were not mere details in a machine. Disputes should be dealt with in a common-sense way, and the Government should intervene only as a last resort. No one wished to see nationalisation extended. Business men were united in a demand for the abolition of Government control. The State should get out of business as soon as possible. There was much to say for co-partnership, but it seemed impossible to apply it; while labour claimed a share in the management it declined to share in the responsibility. Another system of co-partnership was in the form of production bonus. A fair rate should be fixed and agreed upon for output, and additional earnings allowed for everything produced beyond the minimum, so that every worker had a direct interest in the result of his labour. The system had been employed in his own business for several years with great success, and in many cases very large wages were earned. By opposing piecework or payment by results, trade unions had assumed an untenable position. No system of co-partnership could succeed unless the campaign of suspicion and mistrust so assiduously cultivated by the extremists was counteracted and exposed.—*Daily Telegraph.*

Training Ex-Service Men.—A scheme has been prepared by the Ministry of Labour to help ex-officers and ex-Service men to obtain employment. The scheme proposes that training shall be restricted to courses of business training with commercial firms in the United Kingdom. The duration of the scheme is to be limited to one year, and every case will be reviewed at the end of six months. April 30th, 1921, has been fixed definitely as the time limit for all applications. Men undertaking such training will be paid necessary maintenance grants. Full particulars can be obtained from the Ministry of Labour, Montague House, London, or from any office of the District Directorate of the Appointments Department, Ministry of Labour.

Church Lighting.—The artificial illumination of churches, especially those where the architectural features possess the beautiful simplicity associated with the Early English period, has proved one of the most difficult problems that the modern illuminating engineer has had to solve. Such a case occurred lately in the ancient city of Canterbury, where the church of St. Dunstan's, one of the first resting-places of the Canterbury Pilgrims who flocked to do penance at the shrine of St. Thomas à Becket, has lately been converted from gas to electric light.

The rector and churchwardens, desiring to obtain the best results of modern illumination, consulted Mr. Hadyn T. Harrison, M.I.E.E., who advised the use of direct concealed lighting, in order that the architectural features should not be marred by any fittings of modern design.

The beautiful result is clearly shown in the illustration. The illumination obtained is of a high standard, being from

Artificial Church Lighting.

2 to 3 foot-candles; the expenditure of power is 0.3 watt per square foot of floor area, which high efficiency is obtained by the use of gasfilled lamps in combination with "X-ray" reflectors.

The installation was carried out by Mr. S. Terry, electrical and mechanical engineer, of Canterbury; the wiring was done in a very short time, and at a cost much lower, we understand, than is generally expended upon the garish installations which so often disfigure some of our most beautiful buildings.

Late Legal.—British Thomson-Houston Co., Ltd., *v.* Corona Lamp Works, Ltd.—The Court of Appeal, consisting of the Master of the Rolls and Lords Justices Warrington and Younger, on Monday delivered judgment in the case of the British Thomson-Houston Co., Ltd., *v.* the Corona Lamp Works, Ltd, upon an appeal of the plaintiffs from a judgment of Mr. Justice Sargant, in the Chancery Division, dismissing their action for an injunction (and ancillary relief) to restrain the alleged infringement of their patent, which was granted in 1913 for improvements in incandescent electric lamps. The lamp in question was the gasfilled lamp, popularly known as the half-watt lamp. His Lordship held that the patent was invalid by reason of insufficiency, and dismissed the action, with costs.

Their Lordships unanimously upheld the decision of Mr. Justice Sargant on all points, and dismissed the appeal, with costs.

A report of the judgment will appear in our next issue.

Cathodes for Czecho-Slovakia.—Mr. Justice P. O. Lawrence, in the Companies Winding-up Court, on Tuesday last, made a compulsory order for the winding-up of Messrs. Clarke, Jones and Co., Ltd., of Blackfriars House, New Bridge Street, on the petition of Messrs. Brandeis Goldsmidt & Co., financial agents.

It was stated that the petitioners were creditors for £47,000 money lent to the respondent company to purchase 500 tons of electrolytic copper cathodes and other material for shipment to Prague for the Postal Department of the Czecho-Slovakia Government. Liability was admitted, and payment was promised, but had not been made.

Action for Nuisance.—In June last an action for nuisance was brought against Stepney Corporation, in which an injunction was granted to restrain the Corporation from causing a nuisance at its electricity works in Limehouse, but it was suspended for some months to enable the Corporation to make necessary alterations. On Friday last the operation of the injunction was further suspended until the first Friday in the Easter Sittings.

Appointments Vacant.—Assistant (£370) in the physics and electrical engineering department of the Sunderland Technical College; draughtsman for the Bombay Electric Supply and Tramways Co., Ltd.; plumber-jointer for the Derby Corporation electricity department; overhead linesman for the Rawtenstall Corporation tramways; mains foreman (110s.) for the Southend-on-Sea Corporation electricity department; generating engineer (£500) for the City of Bradford electricity department; armature-winding instructor for the Government Instructional Factory at Ponders End; charge engineer (£322) for the Hampstead Borough Council electricity department; sub-station engineer (66s. + 33s. 6d. + 12½ per cent.) for the Walthamstow Urban District Council electricity department; telegraph engineer ($360 per month + 20 per cent., dollar = 2s. 4d.). for the Posts and Telegraphs Departments of the Government of the Straits Settlements. See our advertisement pages to-day.

The Electro-Harmonic "Ladies' Concert."—"To-night's the Night" exclaimed an enthusiastic Electro-harmonican to a friend as they rushed up the stairs leading to the Central Hall of the Cannon Street Hotel on Friday evening last. He was right! The new President of the Institution of Electrical Engineers was in the chair; the hall was filled with a brilliant and appreciative audience, and the concert was an unqualified success from every point of view; one of the best, indeed, if not the best ever given by the Society, certainly since pre-war days. Excellent vocalists, an admirable humourist, a perfect accompanist, and a choice orchestra of picked members of the London Symphony and principal London orchestras, provided by the generosity of the President, himself an ardent lover of the Divine Art, and conducted by a popular member of the King's private band, combined in giving an evening's entertainment which will not readily fade from the memories of those who were present to enjoy it. With such an innovation on the part of Mr. Ll. B. Atkinson, who, we feel sure, was pleased beyond measure at the result of his munificence—for, after all, the orchestra was the outstanding feature of the evening—is it too much to hope that some other affluent member of the Society may be induced to provide a similar attraction for the remaining "Ladies' Night" of the season? It would be not only a gracious compliment to the fair sex, but a welcome engagement to the many eminent musicians who were so hardly hit during the years of the Great War, and who have not yet completely recovered their pre-war status.

Plucky Apprentices.—At a meeting of the Nelson Town Council, Alderman Cooke, chairman of the Electricity Committee, referring to the recent collapse of a generator at the electricity works, paid a tribute to the pluck and coolness shown by two apprentices named Hunt and Kenyon. The machine, he said, went to pieces without warning. As it was collapsing, with metal flying in all directions, Hunt promptly stopped the machinery, while the other apprentice, at great risk, attended to the switches. The Council could not do less than warmly compliment the boys for so pluckily doing their duty. It was suggested that they should receive financial recognition.

Fatality.—William Flemine Douglas, overhead craneman, in the employment of the Kilmarnock Corporation electricity department, was instantly killed, on November 1st, at Annanhill Pit, by receiving an electric shock. The current had been switched off to enable repairs to be executed, and while Douglas was on one of the poles, the current was inadvertently switched on, and he fell 30 ft.

International Patents.—It is reported that the French Cabinet is submitting a scheme to the Allied Governments for the creation of an international patent for inventions, which it is proposed shall be granted by a central office at Brussels.

INSTITUTION NOTES.

Institution of Electrical Engineers.—The New Subscription Rates.—For the information of members interested in the subject, we give below the schedules of subscriptions in force in the Institutions of Civil and Mechanical Engineers respectively. The scale of the Institution of Civil Engineers has stood for many years unchanged, but the question of increasing it is now under consideration. The scale of the Institution of Mechanical Engineers was revised early this year. The proposed new scale of the Institution of Electrical Engineers was given in our issue of November 5th, p. 597.

Institution of Civil Engineers.

	Resident.	Non-resident.
	£ s. d.	£ s. d.
Member	4 4 0	3 3 0
Associate Member and Associate	3 3 0	2 12 6
Student	2 2 0	1 11 6

Admission fees: Full member, £21; Associate Member and Associate, £10 10s.; transfer fee, Associate Member to Member, £10 10s.

Institution of Mechanical Engineers.

	Resident.	Non-resident.
	£ s. d.	£ s. d.
Member	4 0 0	3 0 0
Associate Member	3 0 0	2 10 0
Graduate	1 10 0	1 10 0
,, over 28 years	3 0 0	2 10 0
Associate	4 0 0	3 0 0

Entrance fees: Member, £5; Associate Member, £3 10s.; Associate, £5.

"Resident" means resident in the United Kingdom.

Informal Meetings.—On Monday the first informal meeting of the session was held, the President, Mr. Ll. B. Atkinson, opening a discussion on the question: "Is Specialisation a Danger?" Starting with a treatise on the subject of specialised production by Babbage, he referred to the gradual development of the practice throughout the manufacturing nations, and to the "industrial nausea" to which it led. Mr. Atkinson suggested that a palliative might be found in a system of rotation of duties, whereby a worker's occupation would be varied between wide limits. This system would be immensely facilitated by the universal distribution of electrical energy. He considered that uncongenial occupations were one of the greatest causes of industrial unrest.

North-Eastern Centre.—Members of this Centre are to meet on Monday next, at 7 p.m., at the Armstrong College, Newcastle-upon-Tyne, for the purpose of hearing a statement by their local chairman on the reasons which have made the proposed increases in the Institution subscription imperative. Following the chairman's statement, Mr. W. B. Woodhouse will read a paper on "The Distribution of Electricity."

Liverpool Sub-Centre.—Mr. A. E. McColl read his paper on "Automatic Protective Devices for A.C. Systems" before the Sub-Centre on Monday last. A very interesting discussion followed the reading of the paper.

The Physical and Optical Societies.—A joint discussion will take place next Friday night, at 7 p.m., at the Imperial College of Science and Technology, South Kensington, S.W., on the subject of "The Making of Reflecting Surfaces." Papers will be presented by Messrs. H. N. Irwing, J. W. French, F. Ellerman, J. Rheinberg, R. S. Whipple, C. W. Davidson, J. W. T. Walsh, W. G. Collins, R. W. Cheshire, and Prof. Féry; Messrs. H. A. Hughes and F. Simoon will demonstrate.

Royal Society of Arts.—During the experimental address on wireless telegraphy and telephony delivered on November 17th, by Mr. Alan A. Campbell Swinton, F.R.S., chairman of the Council of the Society, there was to be shown, it was hoped, amongst other things, the automatic printing in ordinary Roman type of wireless messages received in the lecture hall from a distance. That would have been the first time that this fresh departure in wireless telegraphy had been exhibited. The automatic telegraphic printing apparatus that was to be employed is the invention of Mr. F. G. Creed, of Croydon.

Liverpool Wireless Association.—A meeting was held at the Royal Institution on November 10th. The following gentlemen were elected to further augment the committee: Messrs. Grindred, Lewey, Johnston, Balmer, Eden, Lapthorn, and Adlington. Mr. J. Wainwright was elected hon. treasurer. It was decided to commence a course of progressive elementary studies in wireless, especially for beginners, and the first lecture dealing with the subject will be given on November 24th. The meetings in future will start at 7.30 p.m. prompt, and the first half hour each evening will be devoted exclusively to beginners. Mr. Lewey and Mr. Hyde have undertaken the duties of joint lecturers to beginners. Mr. Lewey also promised to give a demonstration with his wireless apparatus on November 24th. Mr. J. Coulton announced that he was in a position to offer members a discount of 20 per cent. on all wireless apparatus. A substantial sum of money has already been given and promised towards the Association's apparatus fund, and further offers of cash and apparatus continue to be made.

Association of Municipal Electrical Engineers (Union of South Africa).—In the course of his presidential address at the annual convention, Mr. T. Wolley-Dod pointed out that while the cost of labour and materials necessary to electricity supply had forced up the price of electrical energy, the only item that had not risen in cost to any extent was the cost of brain work, without which no successful electricity supply concern could exist. The status and remuneration of electrical engineers were receiving the serious attention of the Institution of Electrical Engineers in England, the Institute in South Africa, and kindred societies, and representatives of the Association were in consultation with the South African Institute on the subject.

The President also commented on the variations of the powers of municipalities with regard to electrical undertakings in the different provinces of the Union; in the Cape Province the regulations provided for an unnecessary amount of Government control and interference, whereas in the other Provinces the powers of the municipalities were less restricted. It was proposed to adopt a uniform code of by-laws and regulations throughout the Union, to decide upon the compulsory licensing of electricians for wiring work, and to adopt a common form of statistical returns and accounts; these matters would form the principal work of the Convention, and therefore the programme had been kept almost free from papers on technical matters.

The Faraday Society and Institute of Metals.—A joint meeting of the Faraday Society and the Sheffield Section of the Institute of Metals was held at the Mappin Hall of the Department of Applied Science of the University of Sheffield on November 19th, Sir Robert Hadfield, Bart., F.R.S., and Prof. C. H. Desch, D.Sc., Ph.D., presiding. The afternoon session was devoted to the discussion of problems relating to electroplating generally, and the evening session to the consideration of papers on silver plating. Among the papers were to be the following: "Electroplating for the Prevention of Corrosion," by Leslie Aitchison, D.Met., B.Sc.; "The Use of Colloids in Electrodeposition of Metals," by W. E. Hughes, B.A.; "The Electrodeposition of Cobalt," by Byron Carr; "Electro Silver Plating and its Technical Development," by W. R. Barclay, A.M.I.E.E.; "The Chemical Composition of Old Silver Plating Solutions with Observations on their Working Properties," by G. B. Brook, F.I.C. and W. L. Holmes; "A New Maximum Current Density in Commercial Silver Plating," by Frank Mason, A.M.I.E.E.; and "The Crystalline Structure of Electrodeposited Silver," by G. B. Brook, F.I.C.

South African Institute of Electrical Engineers.—The Institute has recently formed a Telegraph and Telephone Section, and applications for membership in the new section are being received from all parts of the Union.

Birmingham and District Electric Club.—At the last meeting of the Club, a paper was read by Mr. H. C. Young, A.M.I.E.E., upon "Some Aspects of Modern Works Management." The paper was very exhaustive, and dealt with the effects of physical conditions upon labour efficiency. The lecturer showed many graphic records of the effects of hours of work, fatigue, temperature, ventilation, lighting, &c., in which connection he referred to the research work of Dr. Leonard Hill, and Dr. Scott Haldane. Mr. Young laid great stress upon the importance of careful selection of works staffs, foremen, and charge hands, and showed by records that the personnel of a works staff had a very definite bearing upon labour efficiency and upon that bugbear of all employers, "labour turnover." Emphasis was also laid upon the fact that under the new conditions of industry class distinctions tended to disappear, both the commercial and works staffs and the workpeople all came from the same social class. This new factor must be taken into account in dealing with the problems of works organisation. The lecture was a long one, fully illustrated by lantern illustrations, and was enjoyed by a large audience of members and visitors.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Halifax Tramways Committee has decided to recommend the appointment of Mr. J. W. GALLOWAY, as tramways manager, with sole charge in all departments except finance.

The new mayor of Stafford (Mr. R. E. MEADE) was formerly chief of the Corporation electricity department in that town, and now the head of the Gaol Square Motor Co., Ltd.

Mr. J. THOMPSON, the new mayor of Wolverhampton, who is interested in an important local firm of boiler makers, has been for some time chairman of the Wolverhampton Electricity Committee.

Mr. R. G. RAWKINS, who has been elected mayor of Windsor, is secretary of the Slough and Datchet E.S. Co., Ltd., and also secretary and manager of the Kensington and Notting Hill Electrical Installation Co., Ltd.

Mr. J. J. WALKLATE, who was associated with the construction and management of the Kidderminster and Southport, South Staffordshire and Potteries Electric Traction Co., Ltd., has been appointed acting town clerk of Auckland, N.Z. He went to New Zealand some years ago to take over the general management of the Auckland Electric Tramways, Ltd., which was recently disposed of to the City of Auckland Corporation.

Mr. E. P. BEALE has been re-elected chairman of the Birmingham Electric Supply Committee.

Amongst the new London mayors are the following: Bethnal Green, Coun. J. J. Vaughan, electrician; Deptford, Ald. W. H. Green, engineer-secretary, Greenwich and Deptford Trades Council; Greenwich, Ald. B. J. Lemon, a fitter employed by the L.C.C. Tramways Department; Lambeth, Coun. W. S. Bishop, engineer.

Crewe T.C. has increased the salary of Mr. A. LAWTON, of the electricity works staff, from £240 to £260 a year.

Worcester City Council has increased the salary of the electrical engineer (Mr. SHAW) to £800 per annum from September 1st.

Mr. A. G. BELL, the telephone inventor, has come over from the U.S.A. "to pay a farewell visit" to his native city, Edinburgh. Born in 1847 and educated at the Royal High School and at Edinburgh University, he first exhibited his apparatus for the transmission of sound by electricity in 1876. At the last meeting of the Edinburgh Town Council, in reply to a generous tribute by the Lord Provost, Mr. Bell recalled some of his early memories. Although he had been an American for 50 years, he was glad to be at "home" once again.

LORD SYDENHAM OF COMBE has been elected to the office of President of the British Empire Producers' Organisation.

Mr. A. PRESTON, A.M.I.E.E., manager of the Ammanford Electric Supply, which he originally carried out over 11 years ago, has been appointed electrical engineer to the Carmarthen Electric Supply Co., Ltd.

We regret to learn from the *Times* that Mr. A. RICHARDSON, M.P. for Gravesend, became seriously ill early this month and was at once ordered to a private hospital. It will be some time before he can resume his Parliamentary duties.

Obituary.—MR. F. PRESTON.—On November 10th, at 35, Portland Avenue, Stamford Hill, N., the death occurred of Mr. Frederick Preston, late superintendent Central Telegraph Office, London, E.C.

MR. A. STOKLEY.—The death has taken place of Mr. Arthur Stokley, for over 25 years chief inspector of the Northampton Tramways. He was 48 years of age.

MR. WILSON HARTNELL.—We regret to learn from *The Times* that on November 10th the death took place at Roundhay of Mr. Wilson Hartnell, M.I.Mech.E., M.I.E.E., after a few days' illness, at the age of 81.

Will.—Mr. W. Peech, partner in Messrs. Steel, Peech Tozer, of the Phœnix Steel Works, Sheffield, left £533,699.

NEW COMPANY REGISTERED.

Ionoid Co., Ltd. (171,317).—Private company. Registered November 9th. Capital, £1,000 in £1 shares. To take over the business carried on by W. H. Eccles, of 23, Leonard Street, E.C. 2, and to carry on the business of electrical and mechanical engineers, manufacturers of electrical, mechanical, or scientific instruments, &c. The first directors are: W. H. Eccles, 2, Ryder Street, S.W. 1, and 23, Leonard Street, E.C. 2, inventor and designer; Miss N. F. Paterson, 186, Alexandra Road, N.W., secretary; G. V. Twiss, 62, Queen Street, E.C. 4; T. A. Henry, 70, Doneraile Street, Fulham, S.W. Registered office: 186, Alexandra Road, N.W. 8.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Chippenham Electric Supply Co., Ltd.—Satisfaction to the extent of £700 on July 1st, and £500 on July 23rd, 1920, of debentures dated February 13th, 1913, securing £1,200.

Cox-Cavendish Electrical Co., Ltd.—Particulars of £15,000 debentures authorised October 12th and covered by trust deed of October 25th, 1920; present issue £13,750; charged on company's undertaking and property, present and future, including uncalled capital and certain lands and premises in Acton. Trustees: W. N. Howard and H. M. Moore.

W. A. Meadows & Co., Ltd.—Particulars of £500 debentures authorised October 19th, 1920, present issue £300, charged on company's property, present and future, including uncalled capital, subject to existing charge.

Baico Patents, Ltd.—Satisfaction in full on October 2nd of debentures dated June 23rd, 1920, securing all moneys then due or to become due, not exceeding £5,000.

Electric Motors (South Wales), Ltd.—Deposit on October 26th, 1920, of deeds of 1, Wood Street, Cardiff, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd., not exceeding £5,000.

British L.M. Ericsson Manufacturing Co., Ltd.—Issue on November 1st, 1920, of £50,000 debentures, part of a series already registered.

Portable Electric Motors (1919), Ltd.—Satisfaction in full on August 30th of debentures dated June 16th, 1920, securing £5,000.

Direct West India Cable Co., Ltd. (53,956).—Capital, £120,000 in £5 shares. Return dated September 30th, 1920; 12,000 shares, £60,000 paid. Mortgages and charges, nil.

CITY NOTES.

Monte Video Telephone Co., Ltd.

Presiding at the annual meeting, last week, the chairman, the Rt. Hon. Viscount St. Davids, said it was mentioned at the last meeting that they had provisionally arranged a draft concession with the representatives of the Uruguayan Government, and while awaiting the official ratification of this agreement, were surprised to receive a cablegram in March last stating that the Administration of Posts, Telegraphs, and Telephones had invited tenders for a complete underground telephone installation for Monte Video, with exchanges equipped on the central battery system of working. The date fixed for the presentation of the tenders was August 7th last, and only two tenders were lodged—namely, one by themselves and another by the Western Electric Co., Ltd. Under the law as it existed at that date it was illegal for the Government to consider any tenders unless at least three were submitted, and under those circumstances the two tenders which had been submitted were returned unopened. Presumably the law had since been altered, as an official announcement was made in September last extending the time for receiving tenders to December 18th next, when they will be opened irrespective of the number lodged. They still hoped that a satisfactory concession would be granted to the company that would permit the necessary capital to be raised and the City of Monte Video provided with the most up-to-date telephone system that is at present known.

International Light & Power Co., Ltd.—At a meeting of shareholders, on November 11th, Mr. F. Holt (the president), referring to the company's South American properties, said the Venezuelan subsidiary had yielded results in excess even of the favourable expectations, and unless political events upset calculations, the outlook for 1921 was equally favourable. As regards Mexico, both municipal and State administration were suffering from a financial crisis entailing serious hardship to the electric company. The situation with the Regulardo, the Government State banking institution, which holds deposits of the company of 150,000 dollars (U.S. gold) has not improved, although strong pressure is being brought to bear on the Mexican Government in the matter. The Municipality of Méreda has fallen behind in the payment for public lighting supplies by the company, the arrears at the end of the financial year amounting to 200,000 dollars (Mexican). The annual general meeting of the company will be held in Toronto on December 13th.

Stock Exchange Notices.—Application has been made to the Committee to appoint special settling days in the following:—

Benn Brothers, Ltd.—47,000 ordinary shares of £1 each, fully paid (Nos. 1 to 47,000).

The Committee has specially allowed dealings in the undermentioned under temporary regulation 4 (3):—

Fuller's United Electric Works.—50,000 8 per cent. cumulative participating preference shares of £1 each, fully paid (Nos. 1 to 50,000).

Stewarts & Lloyds.—845,542 new deferred shares of £1 each, fully paid (Nos. 1,782,501 to 2,628,042).

Benn Brothers.—47,000 ordinary shares of £1 each, fully paid, Nos. 1 to 47,000.

The Committee has ordered the following to be specially quoted:—

Maclellan (P. and W.).—300,000 ordinary shares of £1 each, fully paid, Nos. 1 to 300,000.

New Issues.—*Siemens Brothers.*—The British Bank for Foreign Trade, Ltd., is offering for subscription 481,875 shares of £1 each at the price of 22s. per share, the balance of the unissued share capital of Siemens Bros. & Co., Ltd. The shares will participate in the final dividend for 1920. The new capital will be used for extensions in hand and contemplated, and for the financing the increasing volume of orders; the value of unexecuted orders is approximately £2,750,000.

Aldershot Gas, Water & District Lighting Co.—Issue of 50,000 7 per cent. redeemable mortgage bonds at par; redemption at par on January 1st, 1931.

Falkirk Iron Co., Ltd.—Subscriptions are invited for £200,000 8 per cent. first mortgage convertible debentures at £95. Holders will have the right to convert into £1 ordinary shares at the price of 25s. per share on any interest date up to and including September 30th, 1930. Annual drawings, commencing 1926 at 102 will redeem all outstanding debentures by maturity on September 30th, 1935.

General Electric Co. (U.S.A.).—The General Electric Co. has authorised the issue of additional stock to the amount of 27,000,000 dollars.—*Reuter's Trade Service* (New York).

Chloride Electrical Storage Co., Ltd.—Interim dividend of 5 per cent., free of tax.

Ever Ready Co. (Great Britain), Ltd.—Dividend at the rate of 7 per cent. per annum on preference and ordinary shares for the period ended September 30th last.

Canadian General Electric Co., Ltd.—Quarterly dividend of 2 per cent. on the common stock.

Altrincham Electric Supply Co., Ltd.—Interim dividend at the rate of 7½ per cent. on ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

It must be admitted that the record of Stock Exchange markets this week is not particularly inspiring. The Russian news and the Greek crisis abroad, and the financial stringency at home make a trio of disturbing elements which compel dull prices in Stock Exchange markets. So great is the demand for capital that new issues offer 8, 9 or 10 per cent. on remarkably good security, and yet the investor complains that when he takes up such stock, the price all too frequently drops to a discount after allotment. Underwriters have to be flattered with tempting terms before they will support new issues. The trouble of it is that nobody can foresee when this state of affairs may be expected to come to an end. But the Stock Exchange, ever hopeful, says that conditions will change for the better early in the new year. To which a fervent Amen will be breathed by everyone who is interested in stocks and shares.

Manufacturing prices are distinctly dull. Edisons have fallen to 16s. 3d.; it is evident that the forthcoming dividend declaration is awaited rather anxiously. The company's first debenture stock is down a point to 74½. General Electrics have lost the 1/16 gained last week. Siemens gave way to 23s. 9d. in spite of the interim dividend being maintained, and the hope that a new issue of shares might provide something in the shape of a bonus to existing holders. But the offer of the shares at 22s. affords nothing of this sort, for the old issue, allowing for the difference in dividends, stands at practically the same price as the new.

Electric Constructions have dropped to 17s. 6d. Babcock & Wilcox fell to 2½, not benefiting for long from the advance in the interim dividend. Vickers weakened to a guinea. Several important amalgamations are declared to be pending in the world of engineering. Whether these be correct or not, there is nothing unreasonable in the assumption that the industrial and financial difficulties will tend to promote closer co-operation between firms in most branches of trade.

Foreign stocks make the best showing in the electricity departments. Mexicans are better again, Mexico Tramways firsts rising 5 to 46, and the seconds gaining 3 at 35. Pachuca fives are also 3 up at 50, and Mexican Light and Power issues are 1 to 4 points higher. These advances pay tardy recognition to the improved situation in Mexico. Nevertheless, a rumour circulated one day last week to the effect that further revolutionary trouble had broken out in Mexico. Unsupported as it was, the rumour gained a certain degree of credence all the same. Everyone felt that it was not inherently improbable. But nothing official came to confirm the report.

The Brisbane Electric Tramways Investment Company has issued a notice to the holders of its 4½ per cent. debenture stock proposing to postpone redemption for three years, instead of paying off the stock at par on January 1st next, the proper date of repayment. It appears that the Queensland Government, returned to power recently with a diminished majority, have not exercised their right to purchase the tramways, and the company has not the money to redeem the stock. The position that has arisen is peculiar and unexpected. A meeting is called for December 8th to consider resolutions for postponement of repayment of the stock, of raising the interest after January 1st next to 8 per cent., and of providing a premium of 2 per cent. if the stock is redeemed within the three years' period.

Home Railway stocks have weakened with the rest of the investment markets, and Underground Incomes at 68½ are 2 points lower. The £10 shares at 2½ are 7s. 6d. down. Metropolitans have fallen a point to 20½, Districts to 18. There is nothing doing in the prior-charge stocks. British Columbias continue to go ahead, the preference, preferred and deferred all rising. Anglo-Argentine Tramways 5 per cent. debenture stock lost its rise of the other day, and is back to 59½, showing a return of over 8 per cent. on the money. On the other hand, the company's 4½ per cent. debenture is 2 higher at 61½.

Electricity supply shares are quiet. London Electrics have been weak, bargains taking place at 15s. 3d. and 16s. 3d. The middle price is called 17s. 6d., and shares could probably be bought at this, if not more cheaply. Chelseas and County of

London keep their recent improvements, but otherwise the list is uninteresting. North Metropolitan Electric Power 6 per cent .preference improved to 12s. Adelaide preference are harder at 13s. 9d. Calcutta Electric Supply shares at 5 have gone back.

There is no indication of dulness amongst cable shares, the Eastern group being again to the front with further improvements. Eastern Extensions, Globe Ordinary and Westerns have all risen, and Eastern Ordinary changed hands the other day as high as 154. The attraction in these cases, as frequently mentioned here, is the fact of the dividends being paid free of tax. Anglo-American deferred has gone back a shade. Marconis are lower at 2⅞. The Marconi Company is substantially interested in a new concern called the British Danubian Trading Corporation, which has been formed to open up and promote commercial relationship between the United Kingdom and Hungary, Austria, Russia, Rumania, Turkey, Poland, &c. In Canadian Marconis there is nothing doing, and the wireless group is quiet as a whole.

Amongst the "dollar" stocks, Canadian General Electrics at 110½ and the preferred at 105¼ are decidedly below the best. Consolidated Gas and Electric of Baltimore weakened to 132¼ after being 135. Rio Tramway firsts at 97 and Sao Paulo firsts at 91½ have both come down. Shawinigans braced up to 125½, a gain of 3, and Milwaukee Electric fives are good at 132. Electrical Development of Ontario bonds improved to 119.

Rubber shares are the turn above the worst. No sustained improvement is looked for until after the end of the year, for weak speculative positions in the raw produce are said to exist in the United States, and these are not likely to be cleared up on this side of 1921.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price Nov. 16, 1920.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	8	12	6	—	£10 0 0
Charing Cross Ordinary	4	7	8½	—	10 15 6
do. do. do. 4½ Pref.	4½	4½	2¼	—	8 8 8
Chelsea	3	4	2¾	—	6 8 0
City of London	8	10	1¾	—	8 17 10
do. do. 6 per cent. Pref.	6	6	17/6	—	6 17 2
County of London	7	8	7½	+	10 18 4
do. do. 6 per cent. Pref.	6	6	8½	—	7 7 8
Kensington Ordinary	6	7	8¾	—	9 6 6
London Electric	Nil	3½	3	— ½	8 12 5
do. do. 6 per cent. Pref.	6	6	5	—	10 0 0
Metropolitan	5	6	2½	—	10 8 8
do. 4½ per cent. Pref.	4½	4½	2¼	—	8 0 0
St. James' and Pall Mall	10	12	6¾	—	9 4 8
South London	5	6	2¾	—	9 12 0
South Metropolitan Pref.	7	7	15/8	—	8 12 8
Westminster Ordinary	8	10	6½	—	9 5 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	77½ xd	—	7 14 10
do. Def.	32/6	1½	16½	— ½	8 18 6
Chile Telephone	6	6	6½	—	*5 9 1
Cuba Sub. Ord.	7	7	7	—	10 0 0
Eastern Extension	8	10	18½	+ ½	*8 12 4
Eastern Tel. Ord.	8	10	159½	+1	*6 11 4
Globe Tel. and T. Ord.	8	10	15½	+ ½	8 11 4
do. do. Pref.	6	6	6½	—	6 17 2
Great Northern Tel.	23	23	20½	—	10 14 8
Indo-European	15	10	80 xd	—	8 6 8
Marconi	25	25	2⅞	— ⅛	8 13 0
Oriental Telephone Ord.	10	12	2½	—	*4 16 4
United R. Plate Tel.	8	8	6½	—	*6 10 8
West India and Panama	1/8	Nil	¾	—	Nil
Western Telegraph	8	10	18½	+ ½	*6 12 4
Home Rails.					
Central London Ord. Assented	4	4	4⅝	—	9 4 0
Metropolitan	1	1½	10½	— 1	6 2 0
do. District	Nil	Nil	18	— ½	Nil
Underground Electric Ordinary	Nil	Nil	2½	— ½	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	5	4	69½	2	—
Foreign Trams, &c.					
Anglo-Arg. Trams First Pref.	Nil	5½	8	—	9 8 4
do. do. 2nd Pref.	Nil	Nil	3½	—	Nil
do. do. 5 Deb.	5	5	59½	—3	8 8 0
Brazil Tractions	Nil	Nil	15	—	Nil
Bombay Electric Pref.	6	6	11	—	4 16 0
British Columbia Elec. Ry. Pfcs.	5	5	59	+1½	8 9 6
do. do. Preferrred	5½	5	58½	+1	*5 19 8
do. do. Deferred	Nil	5	69½	+1	*5 17 8
do. do. Deb.	4½	4½	67½	—	7 7 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	46	+5	Nil
do. 6 per cent. Bonds	Nil	Nil	35	+3	Nil
Mexican Light Common	Nil	Nil	16	+1	Nil
do. Pref.	Nil	Nil	28	+4	Nil
do. 1st Bonds	Nil	Nil	18	+3½	Nil
Manufacturing Companies.					
Babcock & Wilcox	15	15	73	— ½	*5 6 4
British Aluminium Ord.	10	10	1	—	10 0 0
British Insulated Ord.	12½	15	13	—	9 4 8
Callenders	25	15	14 xd	—	10 0 0
" 6½ Pref.	6½	6½	18/9	—	6 18 8
Castner-Kellner	20	17	3	—	5 13 4
Crompton Ord.	10	10	17/6	—	11 8 6
Edison-Swan	10	10	16/3	— ½	12 6 2
do. do. 5 per cent. Deb.	5	5	74½	—1	6 14 8
Electric Construction	10	10	7	— ½	11 8 6
Gen. Elec. Pref.	6½	6½	18/6	—	7 0 5
do. Ord.	15	10	1⅛	— ⅛	*7 12 8
Henley	25	15	11½	—	9 4 8
do. 4½ Pref.	4½	4½	3½	—	7 4 0
India-Rubber	10	10	1½	—	*8 0 0
Met.-Vickers Pref.	—	8	2	—	8 0 0
Siemens Ord.	10	10	1⅛	— ⅛	*8 8 6
Telegraph Con.	20	20	21	+1	*5 14 8

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, November 16th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/10	7d. dec.
a Ammoniac Sal	per ton	£110	£10 inc.
a Ammonia, Muriate (large crystal)	"	£92	...
a Bisulphide of Carbon	"	...	...
a Borax	"	£41	...
a Copper Sulphate	"	£43	...
a Potash, Chlorate	per lb.	1/-	...
a " Perchlorate	"	1/8	...
a Shellac	per cwt.	£33 10s.	...
a Sulphate of Magnesia	per ton	£18	...
a Sulphur, Sublimed Flowers	"	£24	£1 dec.
a " Lump	"	£10	£2 dec.
a Soda, Chlorate	per lb.	6d.	...
a " Crystals	per ton	£12	...
a Sodium Bichromate, casks	per lb.	...	...
METALS, &c.			
p Babbitt's Metal Ingots	per ton	£95 to £300	...
c Brass (rolled metal 2" to 12" basis)	per lb.	1/2½	½d. dec.
c " Tubes (solid drawn)	"	1/8½ to 1/9½	...
c " Wire, basis	"	1/2½	½d. dec.
c Copper Tubes (solid drawn)	"	1/7½	...
c " Bars (best selected)	per ton	£140	...
c " Sheet	"	£149	...
c " Rod	"	£149	...
d " (Electrolytic) Bars	"	£102	£3 inc.
d " " Sheets	"	£143	...
d " " Wire Rods	"	£118	£3 inc.
d " " H.C. Wire	per lb.	1/2½	½d. inc.
f Ebonite Rod	"	3/6	...
f " Sheet	"	3/-	...
a German Silver Wire	"	3/-	...
h Gutta-percha, fine	"	14/- to 16/-	...
h India-rubber, Para fine	"	1/8½	...
i Iron Pig (Cleveland Warrants)	per ton	Nom.	...
l " Wire, galv. No. 8, P.O. qual.	"	£39	...
g Lead, English Pig	"	£38	£4 5s. dec.
g Mercury	per bot.	£15 15s. to £16	...
e Mica (in original cases) small	per lb.	6d. to 4/6	...
e " " " medium	"	5/- to 10/-	...
e " " " large	"	12/6 to 25/- & up	...
p Phosphor Bronze, plain castings	"	1/6 to 1/11	...
p " " rolled bars and rods	"	2/5 to 2/8	...
p " " rolled strip & sheet	"	2/5 to 2/9	...
d Silicium Bronze Wire	per lb.	1/11	...
r Steel, Magnet, in bars	"	1/8	...
n Tin, Block (English)	per ton	£240	£20 dec.
n " Wire, Nos. 1 to 16	per lb.	4/9	...
p White Anti-friction Metals	per ton	£78 to £300	...

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
p ———
r W. F. Dennis & Co.

Post Office Telephone Charges.—Messrs. Rashleigh, Phipps & Co., Ltd., wrote us recently saying that they were very much interested in an article which appeared in *The Times* on the 29th ultimo under the heading of "Telephone Demand Withdrawn," having undergone a similar experience. Some time ago they advised the London Telephone Service that the firm had been converted into a limited company, but beyond changing the style of the firm, business was being carried on on exactly the same lines as in the past. However, before the Department would agree to register the firm's correct title in the Telephone Directory, it sent in a new agreement for the telephone, Museum 2106, with a demand for a surcharge of £4, which the firm considered an unreasonable demand. The department insisted, and owing to pressure of work, the firm sent a cheque for £4. On the 18th instant a letter was received enclosing three new agreement forms for the other three lines, namely, Nos. 2107, 2108, and 2109, with demands for a surcharge of £12.

In view of the withdrawal in the case of the Ideal Films, Ltd., mentioned in *The Times*, the firm considered that it was not only entitled not to pay the £12 demanded, but also to insist on the return of the £4 already paid.

Since then the Post Office has withdrawn the application for the new claims and has refunded the £4 already paid.

German Magneto Invasion.—It is reported that large numbers of German magnetos are being imported into this country, at prices below the bare cost of materials to the British manufacturer, owing to the state of the exchange, and that British magneto works are in danger of closing in consequence of this underselling. According to Mr. F. A. McQuisten, K.C., who was to address a question to the President of the Board of Trade on the subject on Wednesday, 7,000 British employés in the magneto industry are out of work and the rest are working half-time. As magneto manufacture has been proved to be a key industry, steps to protect it are urgently needed.

THE SHIPBUILDING, ENGINEERING AND ELECTRICAL EXHIBITION.—II.

(*Continued from p.* 615.)

Messrs. Ferguson, Pailin, Ltd., are exhibiting a very excellent display of switchgear. The main features are three cubicle sets—a truck type cubicle, an interlocked type, and a non-interlocked type. The truck type cubicle possesses a number of features which will recommend it for sub-station work. The truck cannot be drawn out while the switch is in, and an arrangement comprising a bar, which runs along the top of the case and through the front of the truck, and a small padlock, enables the whole apparatus to be locked up, thus preventing unauthorised interference. When the truck is drawn out, the bus-bar contacts are automatically covered up by slides fitting over the openings in the front of the bus-bar chamber, and all live parts are therefore out of reach from the front unless the partition is removed. The leading-in trifurcating box and feeder isolating switches are also in a separate compartment. The contacts on the bus-bars are of the split circular plug type, and the connectors are porcelain insulated plugs—this ensures a certain contact while any want of alignment is corrected by the flexibility obtained by fitting spring washers on the plugs. The wheels which run on steel rails are fitted with ball bearings giving an easy-running movement. The oil switch fitted in this and other types of cubicle made by the firm has a no-volt release coil in quite a small box in front. This is a special feature permitting the releases to be fitted on any of the firm's switches after installation without re-arranging the rest of the gear. The overload release is very efficient, and if there is a short circuit in the line, the device acts immediately the contacts touch, leaving no chance of "freezing in" or welding the contacts. The tripping mechanism is so arranged that with a shunt trip coil the switch can be tripped with two ordinary primary cells. The ring-type current transformer used is arranged with a porcelain wall ½ in. thick between primary and secondary. The interlock cubicle is designed for operation by the inexperienced. Instead of separate handwheels for each operation—taking out oil switch and feeder and bus-bar isolating switches—one handwheel is employed to carry out the operations in their proper sequence. The position is clearly indicated by a pointer on a dial fixed under the wheel. From the "full on" position the wheel gradually pulls out

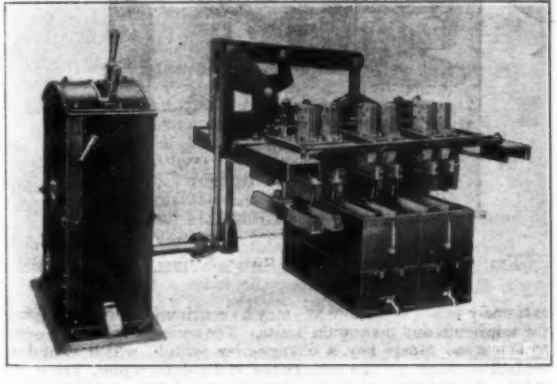

Fig. 3.—A 4,000-Ampere Oil Switch.

the oil switch and then the isolating switches, until the final point marked "Door release" is reached when the operation is complete. A number of oil switches for various purposes appear on the stand. Among these is a 4 000-ampere switch which has no fewer than 138 contacts (fig. 3). All contacts are brought straight through, and stems and nuts are not relied upon. Another switch shown is designed specially for furnace work where a quick "make" as well as break is required. Apparatus of several types appear on a board in the centre of the stand, and includes pillar type isolators capable of dealing with a pressure of 44,000 volts, a three-pole, 1 000-ampere, and a 2,250 ampere single-pole switches, as well as remote-control switches. On the front of the stand is a motor-operated photograph exhibitor which releases a photograph every three seconds, and which can be stopped by a push-button control.

Messrs Campbell & Isherwood, Ltd.—This stand has as main exhibits two small lighting and power sets. The larger is a 15-kw. generator direct-coupled to a "Robey" engine; the other has an output of 7½ kw., and is driven by an "Albion" portable engine. The "C. & I." electric hoist which is shown (fig. 4) is notable for its extreme simplicity of operation. The motor runs continuously, and is always ready for immediate use The load is raised or lowered by a simple downward or upward movement of a lever. Lowering speed is limited by a centrifugal brake avoiding danger from acceleration of the load. The reduction gears are machine cut and noiseless, and all moving parts are mounted on ball bearings. The hoist works on the slack belt principle, avoiding the use of clutches. A range of electric hand-drills is exhibited. These are in three sizes, the largest with a consumption of from 800 to 1,500 watts (depending on the size of drill and material), the next size, 400-800 watts, and the smallest has a consumption of 400-600 watts. The motors are in all cases compound-wound and weather-proof; all live parts are well protected, and the machines are fan-ventilated. The switch case and magnet frame are in one piece, and the cover forms a handle through which passes the spindle connecting the switch to a knob at the end The switch is constructed to give a quick "make" and "break" action. The feed pressure is taken by ball thrust washers contained in the outer housing of the gear-case. Each machine is fitted with a breast-plate easily fitted on the removal of the feed-screw. A portable electric drill is exhibited consisting of a single-

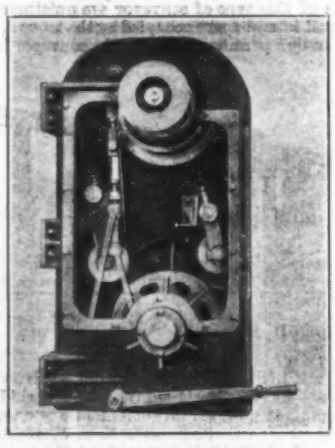

Fig. 4.—"C. & I." Electric Hoist.

speed motor, carriage, universal movement drill head, sliding shaft and switch. This is made in three sizes, and can be supplied with a three-speed gear and attachments for reaming, tapping and grinding. The power consumption of these drills is 1·1 kw. for the smallest size, 1·54 kw. and 3 kw. Magnetic drill stands form another item of the exhibit; these are very adaptable to curved as well as flat surfaces. A great deal of ships' installation work is executed by Messrs. Campbell & Isherwood, and samples of the switchboards made by them are on the stand.

Igranic Electric Co., Ltd.—The main exhibit is a 75-h.p. contactor panel intended for use in connection with ore unloading cranes. This has a load-discriminating device which ensures a regular motor speed, whatever the load. Series relays are fitted to prevent too rapid acceleration or deceleration. Dynamic braking is provided so that should the power fail the load would still be under control, and not thrown violently on to the brake. There are also a number of contactor panels for steel works service, such as the operation of screw downs, live rolls, racks, &c., these panels being of the magnetic lock-out type. There are in addition a.c.

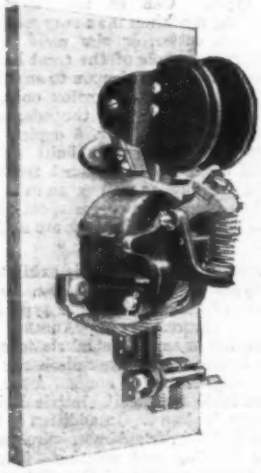

Fig. 5.—Igranic Contactor Control Gear.

panels for ships' plate-rolls and mangles, two panels for push-button control of machines, and automatic starters for printing machines with magnetic disk brake. The space occupied by this gear is very small, and the moving parts are arranged to operate within a limited distance reducing wear to a minimum. Fig. 5 illustrates a shunt type steel works contactor with butt contacts and magnetic blow-out, which is a feature of the exhibit. The special construction gives increased speed of operation, high contact pressures, accessibility, and low maintenance cost.

Messrs. Mavor & Coulson, Ltd.—One of the largest stands in the Exhibition has been taken by this firm, whose products are too well known to need much explanation. The stand is devoted practically exclusively to mining gear. Two underground conveyors occupy a large amount of space. One is a shaker conveyor consisting of a shallow trough or tray, in sections, supported on rollers. It is intended for use on inclined ways, and can be employed with advantage on small gradients. The "jigging" or shaking motion is imparted by an electric motor, or by a compressed air motor. The electric driving gear is extremely compact and robust. Under normal conditions, the power required varies from 6 to 8 h.p., but the standard gears are fitted with 15-h.p. motors. The whole of the motor and switch are completely enclosed. The reciprocating motion is communicated to a rocking arm through a crank and massive connecting rod with adjustable bearings. Among the advantages of this type of conveyor are quietness in operation, portability, small lateral space occupied by the trough, and the small height of the trough permits the use of the conveyor in the thinnest

Fig. 6.—"M. & C." Mining Type Switchgear.

workable seams. The other conveyor is of the endless band type. A number of coal cutters appear on the stand. These are of bar, disk and chain types. One of the latest developments of "M. & C." coal-cutting machines is an easy method of converting a bar cutter into a chain cutter, or *vice versâ*. Originally this was effected by changing the whole of the front half of the machine, but the design has been improved upon to enable the change to be made by removing the "banjo" portion only. A great deal of mining switchgear is shown, and the adaptability of ironclad switchboards is demonstrated. Fig. 6 depicts a typical mine installation consisting of five panels built up with "M. & C." standard industrial units. A three-panel truck-type switchboard is included in the exhibit, as well as an extremely compact type of control pillar, housing controller, fuses, cut-off switch, resistance and ammeter; all internal connections are made before the pillar leaves the works.

The Hart Accumulator Co.—This exhibit comprises a good display of many types of storage batteries. One of the exhibits consists of a battery of six cells, 21-plate type, in lead-lined boxes, suitable for central station work. Another set, suitable for country house lighting or small central stations, consists of 16 13-plate cells in glass boxes; these have a discharge rate of 32 amperes for 10 hours, or 54 amperes for 5 hours. A set of 28 cells of the nine-plate type, suitable for small electric lighting installations and general purposes, is shown. In addition to these are numerous batteries for yacht lighting, telephones, wireless telegraphy, hand lamps, and for car lighting and starting. The various processes and stages in the manufacture of the plates are illustrated by photographs and plates at varying points of production.

The Radio Communication Co., Ltd.—This company exhibits an item of particular interest—namely, the 1½-kw. "Polar" ship's wireless equipment, shown in fig. 7. The transmitter is of the "switchboard" type constructed on the unit principle, and all recording instruments, adjustment controls, &c., are placed on the front of the switchboard panel, while the various elements of the high- and low-frequency circuits are arranged behind it. Four standard wave-lengths are arranged for—300, 450, 600 (normal) and 750 metres. The emergency transmitter supplied with the set gives powers of 100 and 500 watts on the same wave-lengths. The receiver is of the triode-valve type capable of receiving spark or continuous-wave signals. The closed circuit of the receiver is calibrated throughout its entire wave range of from 300 to 7,000 metres for ease of tuning-in to an unexpected signal. Communication up to 300 miles between ships is guaranteed with this apparatus. An automatic starter is fitted and controlled by "start" and "stop" push-buttons. The mechanism is of the multiple finger type, resistance being cut out in four successive stages. The low-frequency transformer is rated at 1½ kw. at 500 cycles per second. The input voltage is 200, and the output is at 10,000 volts. The primary inductance is built up from thin copper strip in the form of a flat spiral; the eddy currents set up are thus

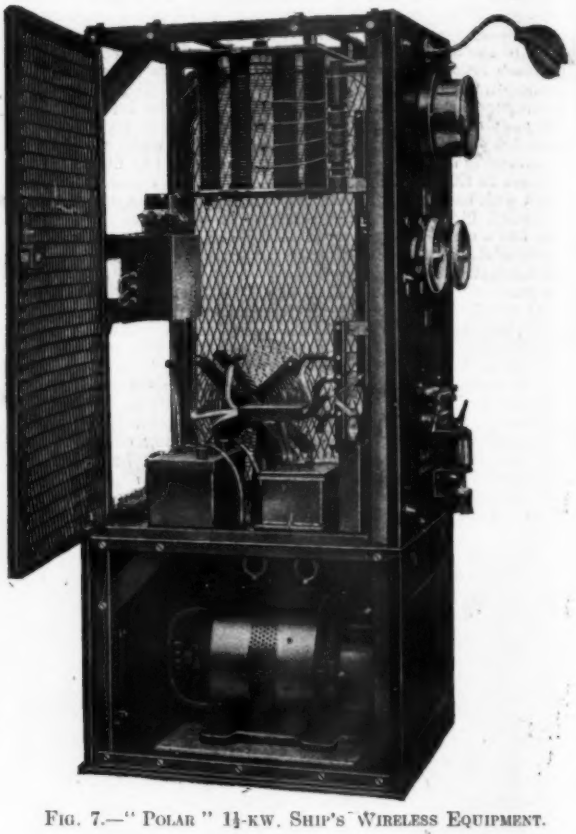

Fig. 7.—"Polar" 1½-kw. Ship's Wireless Equipment.

extremely small, and the wave may be continuously varied between the minimum and maximum limits. The emergency set is operated by the same Morse key, a change-over switch, which contains a contact starting up the emergency motor-interrupter, being provided. In addition to this, the firm shows a 5-kw. continuous-wave set for passenger boats requiring long range communication; a ½-kw. lifeboat set with rotary interrupter and a ¼ kw. "Polar" set on the same lines as the 1½ kw. emergency set. Many types of instruments are exhibited, including an automatic "call" apparatus, which will only respond to the ship's call sign or the S.O.S. signal; a "Townsend" wavemeter in which the oscillatory circuit condensers are fixed, and the wave-length adjustment is made by means of a variometer, as well as a "Kallilotron" c.w. oscillator, "Turner" valve relays, amplifiers, valves, &c.

Messrs. Davidson & Co., Ltd., Belfast.—The apparatus exhibited by this firm includes a marine forced-draught set, consisting of a Sirocco forced-draught fan, 35-in. diameter, direct-coupled to a Sirocco 4 in. × 4 in. enclosed double-acting, forced-lubricated engine. This set, which supplies the air to special furnace fronts through a pre-heater arranged in the boiler up-take, has a capacity of 5,000 cb. ft. per minute at 2½-in. watergauge pressure. For the ventilation of ships the Sirocco fans are of high efficiency and of small size in comparison with their volumetric capacity, and during the war over 8,000 of these fans were supplied to the Navy and the mercantile service for this purpose alone. Messrs. Davidson & Co. are showing one of their marine combinations suitable for placing on the exposed boat deck. It consists of a 20-in. diameter Sirocco exhaust fan direct-coupled to a watertight type motor by the Sunderland Forge and Engineering Co. The firm's exhibit is not confined to shipwork alone, as its products are extensively used in shipyards and engine works. Thus a Sirocco air washer, which has been supplied in numbers for cooling electrical machinery and for furnishing clean air to compressors and buildings, is shown in operation. The washer in question is capable of dealing with 8,000 cb. ft. of air per minute, which, by passing through a thick bank of very fine spray, is thoroughly cleansed of its impurities, and after passing through the scrubber and eliminator plates, is delivered by the fan in a very clean condi-

tion, and without containing any free moisture. In machine shops it has met with great success. A Sirocco steam-heater unit, suitable for low-pressure steam, is on exhibition on the stand. An induced-draught set exhibited is 30 in. in diameter, and is direct-coupled to an enclosed-type engine made by Messrs. Ashworth and Parker.

High-pressure fans for blowing cupolas and forge fires are also represented, one of these being used in connection with that interesting phenomenon of the suspended ball, which has caused many visitors to speculate as to the reason an ordinary football remains stationary in the blast of air emitted by the fan.

The Sirocco mine fan is well known, and a model of this fan is also to be found on the stand. The model represents the double-inlet type of fan, and is arranged for the reversal of air current, which is very clearly shown in this exhibit.

The Leeds Electrical Construction Co.—This company has a good show of electric furnaces, rivet heaters, &c. A number of these furnaces were described at some length in a recent issue of the Electrical Review. The types shown are rotary furnaces for carbon and alloy steel, tilting type for non-ferrous metals, &c. The rivet heaters include portable and stationary patterns. An example of the R.H. 3 type appears (fig. 8); this is capable of heating all sizes of rivets up to and including ¾-in. diameter, and has an average capacity for four rivets per minute. In this heater the rivets are fed into the furnace with the shank-end foremost, and are automatically discharged at the other end. This is effected

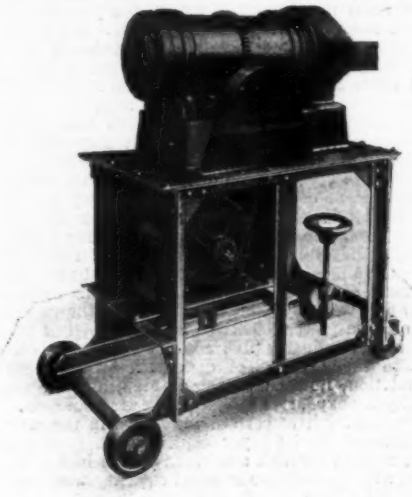

Fig. 8.—Automatic Electric Rivet Heater.

by the rotation of the cylinder, which can be adjusted to give the desired output. The gear for controlling the motor and current input is mounted on a panel situated for convenient and easy control. An automatic temperature regulator, consisting of a thermostat and circuit-breaker can be supplied with this type. The time taken for the heater to reach its maximum temperature from first switching on is approximately 25 minutes. The heating chamber is constructed of refractory materials capable of withstanding temperatures up to 1,600° C. without softening or distortion, and the heating element consists of a winding of special alloy wire. This is a totally British invention.

Callender's Cable and Construction Co., Ltd.—The range of productions exhibited by this firm is very comprehensive. Sections of numerous cables of the firm's manufacture make a very interesting display; all types—paper, rubber, and bitumen insulated, high and low pressure, and various arrangements of conductors, are shown. Cable accessories of all kinds are included, such as joint boxes, fuse boxes, pillars, &c. Wall insulators of porcelain containing oil chambers for E.H.T. work, make an imposing feature. The "Kaleeco" wiring system, with its accessories, is included in the exhibit, as well as a small motor-driven pump, an electric hoist, and samples of "Kalanite" moulded insulation.

Messrs. Marryat & Place.—Lifting magnets and a welding machine form the most important parts of this stand. Demonstrations are carried out on the welding machine showing great ease and efficiency of operation. This machine is designed to deal with mild steel up to ¾-in. thickness. A new roller spot electrode is used in conjunction with the apparatus; this can be used in place of rod electrodes. The lifting magnets shown include a Standard "B" type magnet, operated by an improved contactor pattern of control gear. This magnet can deal with 500 tons of steel rails per day at the cost, it is stated, of about 2d. per hour for power. The master switch is of very robust construction, and is provided with three positions—"lift," "off," and "drop"; it takes up a small amount of space, and can be fixed in any convenient position in the crane-cab without interference with the crane controllers. With the switch in the "off" position a discharge resistance is put across the magnet terminals, and in order to make the magnet release its load smartly, a small reverse current is put through the magnet by placing the switch in the "drop" position.

(To be continued.)

THE INSTITUTION OF ELECTRICAL ENGINEERS.

South Midland Centre.

At Birmingham, on November 3rd, the chairman of the above Centre, Mr. F. Forrest, M.I.E.E., delivered an address, of which an abstract follows:—

From a purely engineering point of view, the Electricity (Supply) Act, 1919, wisely administered, is likely to prove an important means towards national industrial progress. The resultant economy consequent upon the concentration of large and economical generating plant will go far towards counteracting the effect of the recent heavy increases in the price of fuel and labour upon the selling price of electricity. As an indication of what may be found possible in the direction of waste heat utilisation, in a paper read before the Institution recently, Mr. S. H. Fowles stated that the amount of blast-furnace gas which was at present either being entirely wasted or used in a very wasteful manner in this country had a heat value equivalent to 750,000 kw. Furthermore, the Water Power Resources Committee of the Board of Trade in a recent interim report on the water power available showed that although only nine sources of water power in Scotland had been investigated up to the present, they were calculated to yield a total of 183,000 kw., whilst a good case could be made out for the immediate development of a further 300,000 kw.

Although owing to the present difficult financial situation the full development of the national scheme as outlined in the Act may be considerably retarded, it will not be inappropriate just now to consider some of the engineering questions to which the Act will direct special attention.

The type of prime mover chosen for use in the generating stations will be that which under normal working conditions gives a maximum of economy, reliability, and convenience for a minimum investment of capital. As far as our present knowledge goes the high-pressure steam turbine fulfils these conditions best, and is, therefore, likely to be adopted. The size of each individual unit is not likely to exceed 40,000 kw. for single generators, owing partly to difficulties of transport, but also because the increased economy with larger sets will be very small, and this is more than offset by the additional risks incurred due to a smaller number of units being installed. A safe rule to adopt would be that the size of the largest generator installed should not exceed in capacity 20 per cent. of the maximum load on the system it supplies, and spare plant equal in capacity to the largest set installed must be provided and kept available for immediate service. The first and chief consideration must be continuity of supply, and unless some such limit is imposed on the size of the unit, too great a striving after the lowest possible costs may lead to grave embarrassment in case of breakdown. The trend of modern engineering in its search after economy is towards still higher steam pressures and increased superheat. Some of our largest new stations are to run with steam pressures as high as 350 lb. per sq. in. with a total temperature of about 700 deg. F., whilst at one large station now approaching completion it is proposed to reheat the steam between the H.P. and L.P. cylinders of the turbines. The present is, as it were, a transition period in the design of the modern power house.

Gas firing of boilers is at first sight an exceedingly attractive proposition. It cannot be too clearly stated that every process of coal distillation for boiler firing involves considerable heat losses, and the extra heat lost must be compensated for by the production of by-products or substances of greater value than the heat so lost. Unfortunately this is not the case even with the present high price obtainable for the by-products, so that gas firing, with its promise of higher boiler-house efficiency, is not yet a financially sound proposal.

The efficient burning of low-grade fuels has been made possible by improvements in the design and arrangement of mechanical stokers and furnace brickwork, and also by the gradual introduction into boiler houses of men of superior intelligence supervised by expert steam engineers. These men are now greatly assisted in carrying out their work by various accurate instruments, and we are hopeful that shortly it will be possible to replace the CO_2 indicator with an instrument for indicating accurately the excess of oxygen in the flue gas, which is what we really want to know. Further elasticity in the working of the boiler house might be obtained by subdividing the overhead coal bunkers into two unequal parts, the larger part holding fuel of average quality for use during periods of light or moderate loads, and the smaller part holding fuel of better quality for use during periods of heavy load or in case of emergency.

Even with the most economical plant the over-all thermodynamic efficiency of the big generating stations now being considered is not likely to exceed 20 per cent., when running with a load factor of 40 per cent. This is a great advance on what is being accomplished to-day in our smaller and older stations, and it will be found very difficult in everyday practice to greatly improve this efficiency whilst steam is used as the working substance. It is as well to point out that in the average public supply gasworks the gas in the holder only contains 25 per cent. of the heat energy of the coal from which it is obtained. Whilst electricity can be utilised for

power production at a constant efficiency of about 90 per cent., gas can only be utilised for the same purpose at an efficiency of, say, 25 per cent. when the gas engine is new, and at a very much lower figure when it is old. In comparing the relative thermal efficiencies of gas and electricity for the production of power, we see that in the case of electricity the principal loss is incurred in the generating station, and is borne by the supply authority, whereas in the case of gas the principal loss is incurred in the gas engine, and is borne by the consumer. Perhaps it is largely because of this fact that (according to Sir Dugald Clerk) the whole of the towns' gas industry in this country only supplies about 448,000 B.H.P. of gas engines, which is a mere fraction of the total H.P. of motors connected to the mains of our public electricity supply undertakings.

The outstanding features of the design and arrangement of the controlling switchgear which will be installed in the large stations of the future will be safety and *absolute simplicity*. Current limiting reactances, so arranged that every main switch in the station will be capable of satisfactorily breaking the maximum short-circuit current of the circuit which it controls, are likely to be adopted. The prejudice against the use of reactance for the main switchgear which has undoubtedly existed hitherto, is giving place to a better appreciation of the benefits accruing from its use.

Both safety and simplicity are increased by keeping the number of circuits connected to the main busbars down to the absolute minimum. For instance, if there are six generators installed in the station the number of circuits connected to the main busbars should not generally exceed eighteen, viz., six generator circuits and twelve group feeder circuits, each of the latter supplying through current-limiting reactances a sub-busbar to which a group of feeders would be connected.

With the increased size of the new electricity districts, feeder and transmission line voltages are likely to be much higher than the standard pressure of 33,000 volts adopted by Manchester and Birmingham for their new stations. For pressures over this amount three-phase trunk feeders will probably each consist of three single-core, lead-sheathed cables, the copper conductors being stranded over a hemp core to increase their diameter with a view to reducing the potential gradient. We may be sure that British cable manufacturers will be ready to supply E.H.P. cables when required, and guarantee their satisfactory working. I am assuming, as I hope will be the case, that all main transmission feeders will be placed underground (full advantage being taken of the compulsory wayleaves provided by the Act), and only a few transmission lines of secondary importance placed overhead.

Although probably not more than 10 per cent. of the output of the big stations will be used for purely domestic supplies, I want to refer particularly to a means for giving this class of supply from sub-stations connected to the main E.H.P. distributing system. For small L.P. domestic supplies D.C. is on the whole more satisfactory than A.C., apart altogether from the larger question of power factor, and the fact that for equal declared pressures A.C. is at least 41 per cent. more dangerous to touch or handle than D.C. The latter point is of special importance now that so much portable apparatus is being introduced into the modern household. Low-pressure A.C. can at present, however, be supplied to small consumers more cheaply and economically than D.C., because with the former step-down static transformers with an efficiency of about 98 per cent. are employed, and require no regular attention, whereas with D.C., rotary converters must be used having an efficiency of about 92 per cent., and requiring constant skilled attendance. Entirely automatic rotary converter sub-stations have been working with considerable success for some years in the United States, where labour costs are even higher than ours, but I cannot believe that this method is likely to meet with much favour in this country. The ideal towards which we are working is a completely automatic and static sub-station for converting E.H.P. three-phase A.C. into low-pressure D.C., with an overall efficiency approaching that of the modern transformer. The remarkable development during the last few years of the mercury vapour rectifier for sub-station work in sizes up to 500 KW. each, has brought us much nearer to our ideal, and I believe it is apparatus of this character which will be adopted for small traction and lighting sub-stations in the future. As an indication of their successful operation, rectifiers having an aggregate capacity of 55,000 KW. have already been supplied, or are under construction, in Switzerland. A 250-KW. set, I hope, will be working this winter in Birmingham. I have seen these large rectifiers in course of manufacture at Baden, and witnessed them in operation on both traction and lighting systems, working alone or in parallel with rotary converters, and was impressed by their noiselessness, the small space occupied, and the fact that they require no regular attention. They are insensible to variations in frequency, their regulation or voltage rise between no load and full load can be adjusted between 5 and 17 per cent., and their overall efficiency, including the step-down transformer, is about 93 per cent. at 500 volts, and their efficiency is practically constant at all loads. In first cost they are cheaper than rotary converters, and they can be installed in a less expensive building. One disadvantage is that the arc (and, therefore, the D.C. supply) is not self-restoring after an interruption of the A.C. supply, but has to be restarted by means of a small ignition arc temporarily set up between an electrically controlled steel rod plunger and the mercury bath cathode. It is, however, not difficult to foresee that when a fully automatic sub-station is required, some simple instrument of the relay type will be devised to restart a rectifier, and connect it to the busbars after the A.C. supply has been restored.

The work of electrical engineers is expanding daily as new discoveries are made or more efficient methods devised. It is a splendid tradition of our profession, which we must all faithfully observe, that particulars of any new knowledge gained shall be published and made known for the benefit of all, and the proper channel for the dissemination of such knowledge is through the Institution to which we all have the honour to belong.

North-Eastern Centre.

At Newcastle-upon-Tyne, on November 8th, the chairman of the above Centre, Mr. J. R. Beard, M.Sc., M.I.E.E., delivered an address at the first meeting of the 1920-21 session, choosing as his subject "Post-war Conditions and Developments, with particular reference to the Electricity Supply Industry." There follows an abstract of the address:—

Mr. Beard referred to the exceptional circumstances of the times, and drew an analogy between the present times and those which followed the Napoleonic wars. He reviewed the industrial position at some length before turning to the more particular subject of his address—electrical problems. He urged the supreme importance of national recovery, and said when it was viewed from the material side, it was apparent, both from a study of economics and from the experience of other nations in the past, that the most important factor in quickly raising the burden of taxation and restoring national wealth was some special development of applied science. The general application of steam power to industry was the main source of England's recovery from the after effects of the Napoleonic wars. To what should one look for similar assistance to-day? Beyond the bare possibility of the discovery of the key to the almost unlimited energy locked up in the atom, only two main sources were in sight: scientific organisation of production and the closely allied question of the general application of electric power. There was no doubt but that in the electrification of industry this country held a natural advantage, due to the low cost of distribution resulting from its dense population, its relatively small area, and the absence of the necessity for expensive long-distance transmission. During the abnormal growth of certain industries in the war period, it was estimated that 95 per cent. of the new mechanical power was applied through electric motors, while in 557 undertakings the average increase in plant capacity was 101 per cent.

With regard to the question of the adjustment to post-war conditions, the Chairman emphasised the fact that both the actual and relative values of various materials and labour had appreciably changed. He quoted figures by Mr. Frank Walker (published in the "Beama" *Journal*), referring to the influence of the war on costs, and added approximate figures of his own as being of direct interest to those engaged in the electricity supply industry. From his figures the following general conclusions might be drawn:—(1) Transmission and distribution of electricity were relatively favourably situated as regarded materials due to the comparatively low increases in cost of copper and lead. (2) The electricity supply industry benefited from the small amount of unskilled labour employed. (3) It had been affected by the changed conditions no more than the gas industry which was its rival in the domestic field. (4) The relative proportions of capital costs, labour and fuel were approximately the same as they were pre-war, but due to increased rates of interest, capital charges were relatively greater. (5) Revenue had not increased by anything like the same proportion as the working costs, due to a large proportion of the capital employed having been expended in pre-war times. This difference must, however, gradually become smaller since the pre-war plant was steadily wearing out, and all repairs, renewals and replacements must be carried out at post-war values. Economy in generation could be sought in at least eight directions:—(1) Increased use of plant; (2) reduction in the proportion of spare plant for overhaul and stand-by; (3) utilisation of all available forms of waste energy; (4) reduction in capital costs per kilowatt; (5) reduction of operating expenses; (6) improvement in thermal efficiency; (7) utilisation of low-grade fuel; and (8) combination or co-operation with other allied industries. The first six headings depended upon supplying the requirements of each industrial area from a single unified system, while on the most cursory examination the same could be said of the remaining two. The first requirement of a unified system was a general network of mains of the same frequency, but not necessarily of the same voltage, covering the entire industrial area and so much of the agricultural fringe as could be conveniently incorporated with it. The natural development of the unified network was the concentration of generation on the most suitable sites, using the largest units of plant. Advantages immediately accrued under headings (4), (5) and (6) due to the mere increase in size, while further advantages could be obtained under (6), (7) and (8) from the more skilled and specialised design and supervision which could be afforded by a large undertaking. The

six ways of improving economy were interdependent and, in consequence, the design of such a station was one of the most interesting problems in modern engineering. Perhaps the most fundamental problem was to form the correct balances between capital charges and running expenses on the various sections of the plant, and by far the most important balance was that involving the thermal efficiency.

The Chairman submitted a diagram, fig. 1, showing the additional capital expenditure that it was economical to expend in order to save 1/10 lb. of coal per unit, taking into account load factor, cost of coal, and rate of capital charges. For typical present day figures of 40s. per ton for coal and 12½ per cent. for interest and depreciation, the maximum additional capital was £6.3 at 100 per cent. load factor, or £3.15 at 50 per cent. load factor. During the last few years, progress had

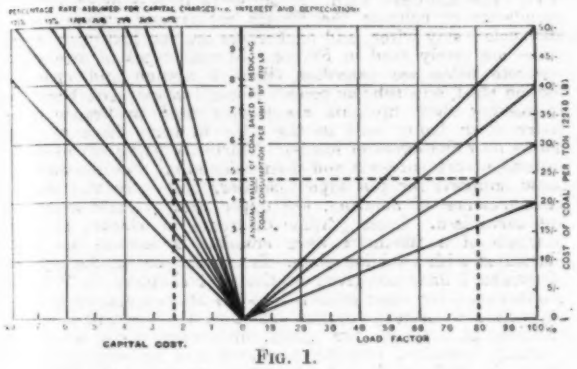

Fig. 1.

been made in cable manufacture, and most makers were prepared to supply cables for a working pressure of 44,000 volts, while 55,000-volt cables were being made commercially in small quantities; there was a general expectation of carrying the maximum pressure to 66,000 volts. The co-ordination of railway electrification with general power supply would have a great influence in facilitating the development of transmission systems.

Considering how capital charges on the distribution network might be reduced, the speaker suggested various methods, summarised under seven headings: (1) Revision of regulations and of antiquated safety precautions; (2) increased use of non-duplicate or semi-duplicate supplies; (3) increased use of overhead lines; (4) reduction of unduly high factors of safety of cables and overhead lines; (5) maximum use of the carrying capacity of the mains; (6) reductions in the amount of switchgear; and (7) savings on buildings.

With regard to safety they had erred from too great caution, and it was time that the regulations were thoroughly revised. He understood that steps were already being taken by the Institution, at the invitation of the Electricity Commissioners, to consider what changes were desirable. It was surprising to what extent unnecessary switchgear was installed. One important direction in which improved economy could be ob-

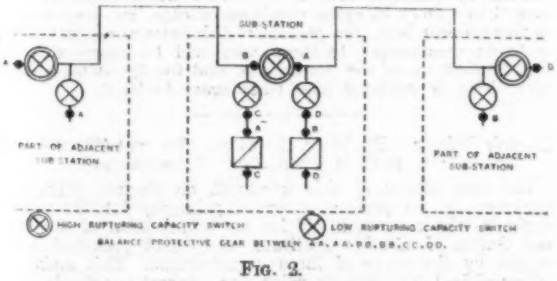

Fig. 2.

tained without capital expenditure was by concentrating the attention of the station operating staff upon the boiler-house and by increasing the technical skill of those responsible for supervising the burning of the fuel. As regarded the problem of combination or co-operation with other allied industries, most of it was in connection with low-temperature carbonisation of coal previous to its being burnt under the boilers, the object being to obtain the valuable by-products. In other directions mutual economy was possible by interworking; with the gas industry, with electric vehicle companies, such as that recently formed in the Newcastle district, and with certain electro-metallurgical industries, and with schemes for public supplies of hot water.

In this country there had been hitherto little high-pressure transmission, as with cheap coal and relatively poor water-power resources it had been economical to generate in proximity to the load. While loads were small, it was unnecessary to use pressures in excess of those which could be taken into industrial sub-stations direct. But that stage had already been passed in some areas. It was quite usual when a non-duplicate supply was given to find a switch on both the high and low-pressure sides of the transformer, when it was obvious a switch on the high-pressure side was sufficient. When it came to duplicate-supply sub-stations for important consumers, the cost of switchgear was a serious item. The need for the usual arrangement was very remote, and he suggested a simplified arrangement shown in fig. 2, which reduced the number of switches from five to three, and lent itself to an arrangement of balanced-protective gear which included the whole of the switchgear, whereas in the usual arrangement the switches and busbars could not be protected without considerable complication. As a result of the protective arrangements the new scheme permitted of the use of lighter and cheaper switches for controlling the transformers, since if, due to a specially severe fault, they should fail to clear, the fault would be no more serious from the system's point of view than the failure of a cable, and would be cleared by the high-rupturing capacity switches on either side. Due to the reduction both in number of switches and in the average rupturing capacity, the overall cost of the switchgear should be reduced to practically half.

The questions of industrial and domestic tariffs seemed urgently to require a settlement, and he suggested that the Institution might usefully call a conference of associations representing the various groups of electricity supply authorities with a view to an agreed standardisation of these tariffs.

Referring to the provision of capital, the Chairman said that to induce a flow of the necessary capital a satisfactory return proportioned to modern conditions must be assured, and it seemed illogical to refuse permission to raise maximum prices until hardship had been proved, based on pre-war rates of interest. In conclusion, the speaker spoke of the importance and need of co-operation, and concluded with the words: "If we are equal to the task and can raise this country to a high level of electrical development, we shall be amply repaid both by its effect on the prosperity of the industrial life of the country and by the assistance which it will afford to our electrical manufacturing industry in obtaining a worthy share in the markets of the world."

REVIEWS.

The Engineering Inquiry (Electrical and Mechanical). By Tomey Thompson. Pp. 367. London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd. Price 7s. 6d. net.

This book is not intended for, and is not needed by, the expert engineer specialising in some particular branch of engineering, but is more for officials who are responsible for the purchase of numerous widely varying types of apparatus or machinery used in general mechanical and electrical engineering work. Purchasing and selling engineers, estimating clerks, agents, and managers will find that the book will greatly assist them to eliminate the continual loss of time and money due to much cross correspondence, by helping them to specify, in the first instance, in their inquiries, the full information needed by manufacturers or sellers, for prompt and efficient tendering purposes.

It is well known that preliminary inquiries for engineering material are seldom put into such a complete form as to be answerable without delay and expense; and it is generally agreed that preliminary interviews with customers are designed invariably by manufacturers for the purpose of obtaining complete information as to possible specifications. It is only when such information has been obtained that the seller or manufacturer can closely estimate on the best or most suitable apparatus he can offer, to meet the various conditions desired. In most cases it is felt that the prospective buyer or his engineer could readily submit a complete inquiry in the first instance, if he were prompted as to the full information desired by the seller or manufacturer, and the aim of the book is to try and do this promptly.

The electrical side of the book appears to be more advanced than the mechanical, but as the book is not by any means complete, and is not likely to be for some time, considering the amount of general information required for such a book, subsequent editions will no doubt be revised and supplemented.

The book might be improved by adding a few typical specifications in full, and by leaving the index portion free from advertisements.

The compiler is to be congratulated upon the large amount of really useful information, and the number of promptings contained in this little book.—E. P.

Direct Current Motor and Generator Troubles, Operation and Repair. By Theo. S. Gandy and Elmer C. Schacht. Pp. 274; 107 figs. London: McGraw-Hill Book Co. Price 15s. net.

In an appreciative introduction, Dr. C. P. Steinmetz describes this book as "a biology, pathology, and therapy of the electric machine." It contains a great amount of thoroughly practical information, most of which is fairly well known to

experienced electrical engineers, but which, so far as the reviewer is aware, has never before been collected into so handy and compact a form.

The authors never depart from the subject they set out to deal with, and all sections are clear and interesting. The sections comprise types of D.C. machines, erection and assembly of dynamos and motors, starting and operation of D.C. machines, D.C. switchboards, troubles and their remedies, tests and repairs.

The chapter on erection and assembly is noteworthy for giving clear and systematic instruction in handling all parts of machines. This work is often left to semi-skilled men, who devise their own methods as occasion arises. The reviewer is of the opinion that a simple course of instruction for workmen based on Messrs. Gandy and Schacht's notes would well repay many British firms.

Other subjects which are dealt with in a specially interesting and useful way are commutation and brushes, while the safety rules given at the end of the book could hardly be improved upon.

The illustrations are excellent, but the complete wiring diagrams, as distinguished from the line diagrams, are somewhat difficult to follow.

It is somewhat unfortunate that the authors did not include A.C. machines in their treatment of the subject, as most of the work is applicable to both A.C. and D.C. machines; and a slight extension would have made a very general treatise of reference.

The book should be greatly appreciated by the great army of engineers who dread mathematical symbols, as the small amount of theory included is of the simplest description. It would also be an excellent text book for the practical side of a works training scheme.—C. W. M.

Lignes Electriques Aériennes. By P. Bergeon and A. Castex. Pp. 240; 96 figs., and 3 plates. Paris: Albin Michel, 22, Rue Huyghens. 1920. Price 12 fr.

This book is one of a series the Bibliothèque de l'Ingenieur Electricien published under the direction of Prof. Barbillion, Director of the Polytechnic Institute of the University of Grenoble. The book is one intended for the use of the practical man and the student, and is written by men in close touch with recent development.

The first chapter starts with the factors which determine the calculation of the percentage loss taken with reference to the energy delivered at the point of departure, and the percentage drop in voltage based on that at the receiving end of a line. It is pointed out that although in an alternating current circuit the voltage drop depends not merely on the resistance, but is also a function of the power factor of the working load, of the radius of the conductor, and of the distance apart of the conductors, yet in the cases usually met with this percentage drop in voltage does not differ materially from the percentage energy loss. This point is demonstrated a few pages later. The useful factor is the percentage voltage drop, and not so much other voltage relations. Methods are given for the calculation of line reactance, and useful approximate methods are given. The advantage of subdivision when considerable current capacity is required is demonstrated. The influence of Kelvin's law on the choice of section of the conductor is noted, and some factors in the choice of voltage are given. It is pointed out that 15,000 volts is about the maximum distribution voltage desirable, when small transformer posts are concerned and simple apparatus is desirable.

Chapter II starts with the mechanical factors; lines on the level and on a slope; the effects of wind pressure, of snow and ice, and temperature variation, are then dealt with. The French Government regulations are based on a pressure of 72 kg. per sq. metre (15 lb. per sq. ft.) on the projected section of the conductor. A factor of safety of 5 is necessary according to these rules when crossing roads or passing houses, and 3 elsewhere. A calculation is given of a 240-metre span across the Rhone. The calculation of voltage drop is dealt with in some detail, and an example given. The mutual induction of two circuits, and the effect and practical calculation of the capacity of a line are then dealt with, and a table is given showing the maximum densities desirable for copper and aluminium conductors.

The fourth chapter deals with the materials used as conductors. Besides copper and aluminium, the authors consider that there is scope for galvanised iron or coppered steel for short, low-powered lines. In general aluminium comes out cheaper than copper, the variations in the price of the former being also smaller than those of the latter. With regard to aluminium, it is stated that practical experience shows that the deposits of snow and ice do not depend on the diameter of the conductor. It is urged that above 50,000 volts aluminium has a distinct advantage when allowing for atmospheric discharge losses. A list of some of the French power companies using aluminium is given. About 400 miles are in use in the neighbourhood of Grenoble. No mention is made of steel cored aluminium, which is now used to a material extent in Germany and in the U.S.A.

Chapter V deals with insulators; glass and porcelain are compared: the lower price of the former is noted. Further space could have been given with advantage to suspension insulators for very high voltage, an illustration of a Vedovelli chain does not show the type of insulator usually associated with the makers in question. Electrical and mechanical tests are then dealt with. The losses at insulators from conduction, hysteresis, surface leakage, and capacity charge are briefly touched upon. For cementing pins Portland cement is preferred, sulphur and litharge are condemned.

The next chapter deals with supports, the minimum height of which depends on the maximum sag at summer temperature and clearance from the highest point of the ground. In France along public roads this clearance is 6 metres, 8 metres at road crossings, and 7 metres from rail level when crossing railways. The three usual methods of arranging pin insulators for three-phase circuits are shown, the superimposed, the upright triangle, and the sideways triangle are shown. The calculation of strain on supports is given. It is pointed out that if the line breaks on a straight line, the bending of the support relieves the strain. The different preservatives for wood poles are dealt with. A simple method is given for the calculation of poles to the French regulations. Twin poles, stay poles, stay wires, and anchorages are touched upon, stay wires are rarely used in France. Several types of armoured concrete poles are described, then I section and channel section steel, and tubular poles. House brackets and brackets supporting short uprights are largely used in France, the latter often being used in the Alps to carry high tension mains over the eaves of houses. Thirty-six pages are devoted to lattice work supports and their calculation, the illustrations show supports for pin type insulators only. To reduce the inconvenience of painting, the upper part of such supports are galvanised. Some graphic diagrams are shown, and an example of a 200-metre river crossing is worked out and illustrated with a folding plate. Practical notes on the lay-out of overhead lines are given in the next chapter. In France a usual span for wood poles is 35 to 45 metres, and with steel supports 100 metres; practical notes on the pegging out and erection of supports are given, and then come notes on jointing, branches, and inlets. Road and railway crossings are dealt with, and a short section is given on lightning protection; more details could perhaps have been given with regard to this latter. Difficulties with horn arresters are noted, and the controversy regarding the use of a superimposed earth wire is mentioned.

In the last chapter notes are given on the testing of lines and the location of faults. An appendix gives extracts from the French regulations.

The authors in their examples and notes have very largely relied on the practice current in the French Alps. In the book there is almost an entire absence of that undigested scissors and paste which is such an objectionable feature in many modern technical books. Most of the notes given apply to lines up to 70,000 volts, that is to say, of a character most likely to be dealt with in the British Isles in the near future. No attempt is made to enter into elaborate explanations of phenomena or formulæ, and the calculations are of a simple character.

It might be noted that as a large proportion of the technical words are nearly the same as in English, and the text is written in short sentences, the book can be understood by those who have only a moderate knowledge of French.

It is understood that amended regulations for the erection of overhead lines will be drawn up very shortly, and it is well known that those which exist, and the policy which has been adopted in the past by the B.O.T., have not been favourable to the development of overhead transmission or distribution in the United Kingdom. As this book has been written by practical men in a country where probably well over thirty times as much overhead mileage has been erected as there exists here, the perusal of this interesting little book is to be commended to those who will be responsible for the drawing up of the regulations, and for the departmental supervision of overhead lines when erected.—T. R.

Electric Wiring. By W. S. Isbetson. Pp. vi+463; 218 figs. London: E. & F. N. Spon, Ltd. Price 18s. net.

The new edition of this handbook on electric wiring is, according to the preface, intended primarily for the use of students who propose to sit for the examination of the City and Guilds of London Institute, and must presumably be judged by the scope of those examinations. This makes it rather difficult to judge its value as a general handbook, as it involves limitations on the author. He naturally tends to scheme the book in a fashion that suits the examinations rather than the working needs of the student, and the two do not always correspond.

The sections devoted to theory—Chapters I to IV—are, for example, too brief to be really of much value. They would no doubt give a wireman sufficient knowledge of the units of electricity, and so on, to pass the examination, but hardly sufficient theory to be of much practical value to him. One oversight in them should be corrected, viz., the ignoring of the efficiency of the motor in examples 61 and 65.

In a somewhat similar way the chapters devoted to the details of actual apparatus—filament lamps, arc lamps, fuses, switches, &c., are perhaps unnecessarily detailed. The student, who may be assumed to have some practical experience with such apparatus, hardly needs large-size illustrations of direct and indirect lighting fittings, lamp holders, switches, and plugs.

It is probable that the space devoted to these items would be better used in a more complete description of wiring

systems, in fuller discussion of their relative advantages and disadvantages. For example, no mention is made of Stannos wiring, and even though the author may think it an unsatisfactory system, it should be considered, as it is sometimes used. The use of slip tubing, and the practice of threading conduit on wires, should also be condemned much more strongly.

Another important matter that has been omitted is some reference to and discussion of the use of the small automatic plants that have been so much developed in recent years. These also have many defects in principle, and this may account for the omission of all reference to them, but they are being largely installed, and the section dealing with the subject of small isolated plants with batteries should have included details of the principles involved in their use.

In spite of these omissions—due doubtless largely to the scope of the book, which is perhaps too great for a single volume—the book is well written, and covers the essentials of the subject fairly exhaustively. The examples are for the most part clearly worked out—though there is a glaring arithmetical error in paragraph 473—and the student would undoubtedly find the book of great assistance to him in working up for his examination. It would have been advantageous if all the tables could have included the new cable sizes, as it is rather annoying to see these properly given in table 10, but the old sizes used in tables 1 and 5. It is also annoying to see again the old Simplex schedule of "wiring capacity of conduits." Standard tubing properly installed will take appreciably larger cable than in this table, and it is rarely that an experienced wireman does not use (what is the same thing) smaller conduit than this table allows. The I.E.E. should investigate the question, and get it properly settled, as a table quoted so largely in text books and usually ignored in practice is not satisfactory.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Telometer.

Measured service is the only practical method of selling telephone service, but the essential requirement, a satisfied subscriber, is only to be obtained by installing a recorder at the subscriber's terminal so that he may keep an accurate check on all his completed calls. An instrument which is claimed to fulfil all the necessary requirements is fully illustrated and described in the October issue of the *Telephone Engineer* under the name of the "telometer." The device, shown in fig. 1, is compact and substantial, with little to get out of

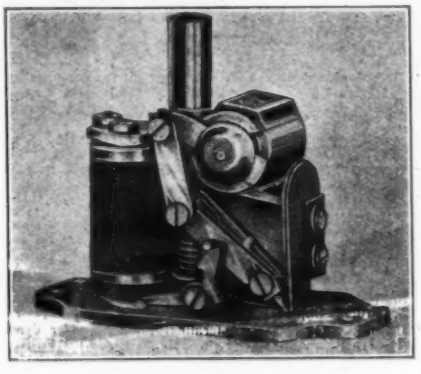

Fig. 1.—The Telometer.

adjustment, and it can be attached to or adjacent to any type of telephone instrument. The subscriber has control of the recording mechanism; he must partially record the call before he can signal the exchange, but he cannot prevent the subsequent recording of the call when it is completed, as this is done automatically by the response of the called subscriber, and no additional work or dependence is placed on the operator. To initiate a call the subscriber depresses a button,

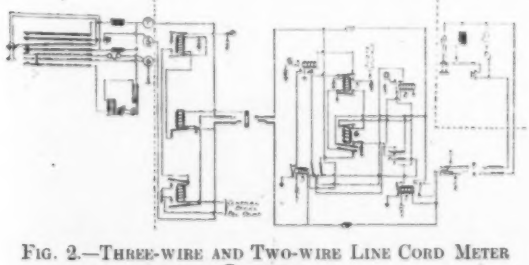

Fig. 2.—Three-wire and Two-wire Line Cord Meter Circuits.

which action turns the recording dial one step, and by a combination of levers and latches locks the meter in the operative position. When the receiver is removed from the switch hook, the operator answers in the usual manner. When the called party responds, advantage is taken of the action of the supervisory relay and light to operate a quick-acting relay (5), fig. 2, and send an impulse of excess voltage over one side of the line to the meter through contact springs and thence through electromagnets to earth. The electromagnets complete the recording of the call. The action of relay (5) allows the battery current to flow through relay (6); the latter relay, however, de-energises (5), thus stopping the flow of excess voltage and locking (5) to prevent any further impulses of excess voltage going out. Consequently only one record can be made on any one call, even though the subscriber should inadvertently depress the button. If the called party does not answer, the impulse of excess voltage is not sent out and the meter remains in a locked operative position ready to signal central on the next call; yet the button is locked and the recording device cannot be moved forward until after a call, originated at this telephone, is completed; thus the total number of calls recorded is determined by the actual number of calls completed. In the case of a wrong number call; when the wrong party answers the call will be recorded, but when the calling subscriber ascertains he has received the wrong party he can again signal central without pushing his button, by working his hook switch which will operate the supervisory isgnal. As long as relay (6) is in a locked position it is impossible to completely record another call, even though the subscriber has again depressed the button, thus only useful and intended calls are recorded. On a reverting call, *i.e.*, where one party on a line desires to talk to another party on the same line, the operator, after ascertaining that the parties are talking, will press a key, which registers the call on the meter, but does not interfere with the service, as relay (6) has locked up, controlling the circuits that were routed through this key. Reference to fig. 2 will show that the meter cannot be operated on a busy test. The margin between the regular voltage on the line and cord circuits and the voltage of the impulse to unlock the meter is so great that there is no probability of the meter operating until intended. The transmission of voice currents, however, is in no way impaired, as all meter apparatus is electrically disconnected when the meter operates. In the circuit drawing is also shown an extra relay in the line circuit which is necessary only when a certain office peg count is desired in connection with the subscriber's station meter. This constitutes no part of the invention and is shown only for its possibilities. This circuit and apparatus has been tested and found to operate satisfactorily over a line with a total loop resistance of 800 ohms. With the electro magnets in the meter wound to 500 ohms the supervisory signals will operate perfectly.

Fire-proof Doors.

One of the specialities manufactured at Messrs. Fraser & Chalmers' Engineering Works, Erith, Kent, is fire-proof doors, the use of which is an effective means of preventing the spread of fire in large buildings. The firm's design has been approved by the L.C.C. and other authorities, including the principal insurance companies. The frames are welded up solid from steel angles and T sections, providing a structure which it is claimed will not distort under the influence of heat. Moreover, the method of construction permits the doors to be fitted and every detail, including locks and handles, to be completed by the manufacturer prior to dispatch, and facilitates erection on site as the frames are delivered together with the doors intact, leaving only the final grouting in the wall openings. Each wall opening is provided with double doors, which may be either single-panel or multiple-panel folding section doors.

The "Edison-Acme" Accumulator.

The Edison-Swan Electric Co., Ltd., of Ponders End, Middlesex, is manufacturing an accumulator under the name "Edison-Acme" to a special design and constructed in such a manner as to enable it, it is claimed, to withstand vibration and give an ampere-hour efficiency of 92 per cent. The cell cases are made of strong double-weight celluloid, and are fitted with sealed lids, vent plugs, and non-corrosive terminals; nickel-plated screw terminals are fitted if specified when ordering. The cells may be grouped in polished wood cases,

crates, or enamelled metal boxes with strap handles as desired. They are made in a variety of sizes in both the vertical and horizontal types, the latter being intended to meet the requirements of positions where height is limited and the elevation is too low to permit the use of the vertical type. The batteries, besides fulfilling ordinary requirements, can be made up to suit any make of motor car for both lighting and ignition purposes.

The "Ideal" Log Fire.

Realising that there always has been a large section of the public to which a log fire makes an irresistible appeal, the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C. 4, has designed an electric log fire, known as the "Ideal," and illustrated in fig. 3. It is a realistic imitation of a stack of burning tree logs on an iron cradle stand, the "logs" being moulded in earthenware, and from the crevices, representing the natural roughness of the bark, red-hot resistance wires

Fig. 3.—"Ideal" Electric Log Fire.

emit a pleasant glow, giving the cheery and comfortable effect of a log fire with none of its drawbacks of pungent smoke or dirt from charred fragments. No work in cleaning up is required, and the "logs" are permanently in position, the heat being controlled by a switch on the wall. The consumption of electricity is 2 units per hour, and the overall dimensions of the fire are 16 in. high, 20 in. wide, and 12 in. deep, and the weight, including the stand, is 42 lb.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

30,775. "Electric heating and cooking apparatus." J. R. Baird and G. Pate. November 1st.
30,783. "Terminal for electric connections." A. J. Cheyne. November 1st.
30,788. "Protective ferrule for electrical conduits, &c." F. W. Uren. November 1st.
30,805. "Electric light fittings." E. Stroud. November 1st.
30,825. "Recording and reproduction of sounds." W. H. Meusser and E. Waltz. November 1st. (Germany, November 1st, 1919.)
30,826. "Amplifier connecting apparatus for telephonic installations." Siemens & Halske Akt. Ges. November 1st. (Germany, October 31st, 1919.)
30,829. "Electric switches." Edison Swan Electric Co. and F. Shergold. November 1st.
30,863. "Transmitter for talking machines, &c." L. L. Fountain. November 1st.
30,937. "Electric stoves." Quain Electric Co. & J. R. Spink. November 2nd.
30,946. "Sparking plugs." A. W. Armstrong. November 2nd.
30,963. "Power plant for vehicles." P. C. Leidich. November 2nd.
30,984. "Induction relays." Cutler-Hammer Manufacturing Co. and Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). November 2nd.
30,985. "Thermally controlled circuit interrupters." Cutler-Hammer Manufacturing Co. and Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). November 2nd.
30,986. "Motor control systems." Cutler-Hammer Manufacturing Co. and Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). November 2nd.
30,987. "Controllers for electric motors." Cutler-Hammer Manufacturing Co. and Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). November 2nd.
31,016. "Electric motor car lamps." E. G. Sanguinetti. November 3rd.
31,035. "Motor car electric lighting sets." Automobile Service, Ltd., and E. J. Were. November 3rd.
31,042. "Electrical sounding device." W. E. Rademaker. November 3rd.
31,052. "Apparatus for electro-deposition of metals." W. Turton. November 3rd.
31,053. "Electric harmonic analyser." M. Walker. November 3rd.
31,059. "Luminous electric discharge lamps." E. Schaeffer. November 3rd. (Germany, July 14th.)
31,093. "Means for transmitting and recording telephone, &c., messages." J. H. Robertson. November 3rd.
31,094. "Electric relays." M. D. Dimitrievitch. November 3rd.
31,098. "Electric lamp shades, &c." J. Webber. November 3rd.
31,147. "Arc generators for producing oscillating currents of high frequency." P. O. Pedersen. November 3rd. (Denmark, August 5th.)
31,150. "Electric transmission." A. M. Tayler. November 3rd.
31,166. "Electric motors." Lancashire Dynamo & Motor Co. and R. S. McLeod. November 4th.
31,176. "Electrical heating or cooking utensils." H. Cheshire, Cranmer and Cheshire, and V. Summerhayes. November 4th.
31,180. "Electric heating units." H. Cheshire, Cranmer & Cheshire, and V. Summerhayes. November 4th.
31,182. "Switching apparatus for automatic, &c., telephone exchange systems." D. L. Lienzen. November 4th.
31,206. "Medical coils for use with dry batteries." I. M. Ford. November 4th.
31,207. "Means for charging secondary batteries." E. L. Burne. November 4th.
31,225. "Locking lamp holder for incandescent electric lamps." A. J. Barker. November 4th.
31,230. "Electrical speed regulator." E. Dick. November 4th.
31,233. "Electric transformers." Metropolitan-Vickers Electrical Co. (Westinghouse Electric & Manufacturing Co.) and Westinghouse Electric & Manufacturing Co. November 4th.
31,244. "Telephony." A. J. Roberts. November 4th.
31,275/6. "Electric kettle, &c." J. M. Colson. November 4th.
31,284. "Battery ignition systems for internal combustion engines." R. Bosch. Akt. Ges. November 5th. (Germany, November 13th, 1919.)
31,298. "Telephone systems." Automatic Electric Co. and Automatic Telephone Manufacturing Co. (Automatic Electric Co.). November 5th.
31,301. "Employment of thermo-electric principles in steam engines for condensing vapours." A. L. P. Mark-Wardlow. November 5th.
31,317. "Electrical wiring systems." H. F. McLoughlin. November 5th.
31,318. "Continuity devices for metallic conduits and fittings for electric cables." H. F. McLoughlin and Simplex Conduits, Ltd. November 5th.
31,340. "Electric glow devices." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. November 5th.
31,344. "Electric switches." G. Lehmann. November 5th.
31,346. "Terminal banks for selector switches." Western Electric Co. (Western Electric Co.). November 5th.
31,362. "Oil-cooling stators of dynamo electric machinery." H. N. Dutton. November 5th.
31,371. "Call distributing arrangements for telephone plants." G. A. Betulander. November 5th. (Sweden, November 22nd, 1919.)
31,372. "Electrically heated vulcanising apparatus." H. Frost & Co., W. H. Welch. November 5th.
31,376. "Electron discharge devices for wireless communication." J. Scott-Taggart. November 5th.
31,403. "Electric toasting apparatus." A. Ness. November 6th.
31,426. "Adjustable joints for electric light stands, show stands, &c." J. S. Bruce. November 6th.
31,429. "Signalling apparatus." J. Meyes. November 6th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

17,916. "Method of and means for producing alternating electric currents." British Thomson-Houston Co. (General Electric Co.). December 13th, 1916. (152,365.)

1919.

11,687. "Manufacture of incandescent electric lamps." F. Harrison. May 9th, 1919. (152,377.)
11,800. "Electric incandescent lamps." F. Harrison. May 10th, 1919. (152,378.)
11,935. "Manufacture of incandescent electric lamps." F. Harrison. May 13th, 1919. (152,379.)
14,994. "Receivers of wireless signals." E. E. Franks. June 13th, 1919. (152,386.)
17,247. "Process for electrolytic decomposition of anhydrous magnesium chloride and the production of magnesium and chlorine." E. A. Ashcroft. July 9th, 1919. (152,402.)
17,424. "Static electrical condensers." British Thomson-Houston Co. and R. C. Clinker. July 11th, 1919. (Cognate application 24,106/19.) (152,409.)
17,521. "Brush rocking gear and terminal mechanism for dynamo-electric machines." H. D. Rohman. July 12th, 1919. (152,418.)
17,583. "Radiating antenna systems." British Thomson-Houston Co. (General Electric Co.). July 14th, 1919. (152,422.)
17,701. "Electric radiators and the like." English Electric Co. and R. Weaving. July 15th, 1919. (152,429.)
17,870. "Electrical low-tension oil switches." R. T. Norton. July 17th, 1919. (152,438.)
17,893/4. "Switching apparatus for selecting and operating sets of electrical contacts." Relay Automatic Telephone Co. April 2nd, 1919. (141,005/6.)
18,963. "Electrical switches." W. H. Tonks and W. Sparks. July 31st, 1919. (152,451.)
20,202. "Electric locomotives." T. Zweigbergk. August 16th, 1919. (152,469.)
21,113. "Connectors for wires and electrical conductors." J., A. Halpin. August 28th, 1919. (152,480.)
21,618. "Electric light fittings." S. T. Jordan. September 3rd, 1919. (152,483.)
22,371. "Electric motor control systems." T. Zweigbergk. September 11th, 1919. (152,490.)
24,813. "Electric resistance heaters and furnaces for high temperatures." Soc. Anon. des Ateliers de Secheron. October 10th, 1918. (133,706.)
24,816. "Printing telegraph systems." Western Electric Co. (Western Electric Co.). October 10th, 1919. (152,514.)
26,013. "Electric light carbons." Siemens & Co. Geb. August 5th, 1916. (134,235.)
26,333. "Electric heating apparatus." W. B. Smits. May 5th, 1919. (142,779.)
27,933. "Apparatus for electrically controlling air brakes." W. J. Mellersh-Jackson (E. P. Waterhouse and B. A. Prince). November 11th, 1919. (152,535.)
28,743. "Electric furnaces." Soc. Anon. des Ateliers de Secheron. February 12th, 1919. (Addition to 133,706.) (138,858.)
28,744. "Electric resistance heaters and furnaces for high temperatures." Soc. des Ateliers de Secheron. February 12th, 1919. (Addition to 133,706.) (138,859.)
30,191. "Electric lamps for illuminating dash boards of motor vehicles or for like purposes." Rotax Motor Accessories Co. and E. Hill. December 3rd, 1919. (152,541.)
30,520. "Electric resistance heater for melting furnaces." Soc. Anon. des Ateliers de Secheron. December 28th, 1918. (Addition to 133,706.) (137,276.)

1920.

5,586. "Electric circuit closers." Benjamin Electric Manufacturing Co. March 3rd, 1915. (139,485.)
7,224. "Cord grips for electric lamp holders." V. Hope. June 10th, 1919. (Divided application on 14,614/19.) (152,572.)
8,484. "Electric musical instruments." C. E. Hugoniot. April 30th, 1919. (142,447.)
8,914. "Alternating current dynamo-electric machines." Siemens-Schuckertwerke. March 29th, 1916. (140,811.)
17,189. "Field magneto for dynamo-electric machines." Siemens-Schuckertwerke. July 25th, 1920. (148,748.)